ELECTRICAL REVIEW

May 30, 1947

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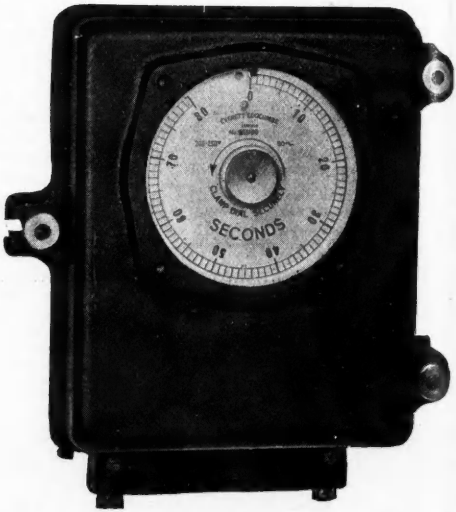

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXL. No. 3627 MAY 30, 1947 9d. WEEKLY

Testing in Service

Value of the Grid in Obtaining Operating Experience

ON whatever scale pre-installation tests may be carried out and however close their approach to conditions of usage, purchasers are likely to feel most confidence in the performance of equipment of a type that has been proved in actual operation. A valuable feature of the national grid, which has perhaps been overshadowed by successful fulfilment of the primary purposes for which it was built, is the scope it provides for obtaining field experience in the functioning of high-voltage apparatus over extended periods.

Switchgear and Transformers

Taking switchgear as a first example, oil-filled 132-kV circuit-breakers, originally constructed for 1·5 MVA, have demonstrated the soundness of their design through their ability, after modification, to cope with 2·5 MVA where the growth of load has made this necessary. More recently air-break gear at that voltage, which promises even more rapid operation and lends itself better to auto-reclosure, has been introduced. Transformers, up to 75 MVA as three-phase single units, have been on the line since the earliest days of the grid with on-load tap-changing and other advanced regulating devices. Their ability to withstand transient surges and other working stresses has given them a top position for general reliability.

Although the total mileage of cables installed forms only a small proportion of the whole grid system of more than 5,000 miles, these have thoroughly justified their use in series with overhead lines to carry the normal loads, where economic considerations have not predominated and the distance has not been great enough for capacitative effects to be troublesome. Notable examples are the first 132-kV three-phase three-core cable in the world and the first single-core cable at the same voltage to be laid under water. All the grid 132-kV cables with their joints and sealing ends have stood up to 640-kV impulse tests, which have also furnished information that is expected to lead to the development of more economic designs of switchgear. Common to both cables and switchgear also is the application of gamma radiography to examine joint construction, without dismantling, and the internal condition of metalclad units.

Higher Voltages in Prospect

Looking ahead, the Central Electricity Board is making its plans for the adoption of higher voltages than the 132, 66 and 33 kV now in use. It has arranged for the construction of a 264-kV line and has ordered a three-phase bank of testing transformers for carrying out tests on an experimental 400-kV line to be erected this year. Reports of progress in manufacture and other articles that have appeared in our pages show that circuit-breakers, transformers and cables for 264-kV are now available. Although d.c. seems an unlikely competitor with a.c. under the conditions now obtaining in this country, the possibility of openings abroad will, no doubt, be taken into account in deciding whether field experiments in this direction also would be warranted by the experience to be gained.

Thorough investigations into the types of insulators that have shown themselves most reliable in foggy, dirty or salty atmospheres, the causes of deterioration of conductors and joints, the speedy operation of pilot-less protective gear and the combating of the effects of lightning and other transient phenomena are among the research activities that have resulted in a notably trouble-free service in all its technical aspects. This is exemplified by a record of about 93 per cent of faults that are correctly cleared each year. It is evident that the grid has done more than provide valuable testing opportunities to British manufacturers which supplement their own extensive resources. It has also demonstrated that they can not only supply the apparatus but can install transmission systems anywhere to give the highest standard of performance.

Through Committee

STANDING Committee E of the House of Commons succeeded in disposing of the rest of the clauses of the Electricity Bill before Whitsun without being forced to resort to the short-circuiting measures applied to other major Bills this session. The Bill emerges from the committee stage without substantial alteration but several clauses have been clarified and a number of assurances have been given by the Minister of Fuel and Power that views expressed during the discussion will be given due weight when the Bill is reported to the House. Both friends and opponents of the measure have had full opportunity to discuss the various clauses and it is to be hoped that with some of the sharp edges rubbed down and with the Minister apprised of practical difficulties in operating some of the provisions the final Act will be an improved measure. Much credit is due to Sir Arnold Gridley for his constructive handling of the case for the Opposition and to Mr. Gaitskell, Parliamentary Secretary to the Ministry, for his sympathetic reception of suggestions made by members.

Future of "Non-Stats"

A SUBSTANTIAL concession was secured in the Standing Committee by Mr. Foster when he attempted to secure the insertion of a new clause protecting non-statutory undertakers from the probable effects of nationalization. Although Mr. Shinwell could not accept the clause (he said it went too far) he promised to consider the introduction, at the Report stage, of a new clause to enable "non-stats" to require their undertakings to be acquired on agreed terms or, if necessary, terms settled by arbitration. Many of these small undertakings have served their public well and their extinction without compensation would be most unjust.

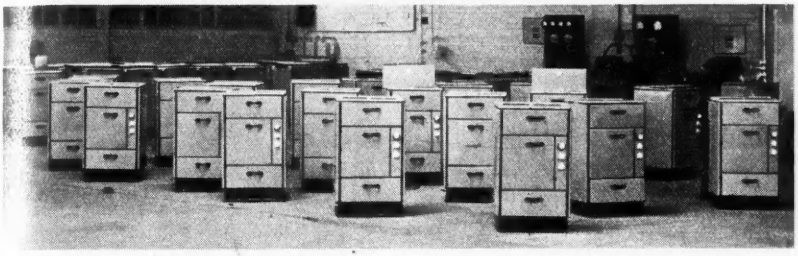
April Exports

CRITICS of the Government's policy of permitting the export of heavy electrical plant will find further ammunition in the April trade returns reviewed on page 901 of this issue. The figures show a rise of about 175 per cent in "machinery" exports as compared with April last year much of it due to greater shipments of generators of more than 200-kW capacity. Increased exports to Russia were responsible for most of the advance. No doubt there are good reasons for the apparent inconsistency between the need for generating plant here and increased export trade in this plant. The electrical manufacturing industry is one of those which are looked to for an extra export quota to counterbalance deficiencies in other directions. One satisfactory feature of the electrical export trade as a whole was the improvement in supplies to Latin American countries; Argentina, for instance, rose to third place in the list of customers for electrical goods and apparatus, becoming the most important non-Empire market.

H.V. Cable Testing

ALTHOUGH underground cables have inherently lower surge impedances than overhead lines, they are by no means free from risk of damage from lightning. Tests at power frequency do not indicate behaviour under conditions in which very great amounts of energy are liberated from electrostatically charged clouds. Phenomena of this nature can, however, be imitated in relevant aspects by impulse testing, i.e., by charging and rapidly discharging high-voltage capacitors under close control, which also permits the taking of oscillograph records. The 1·2-MV impulse-testing plant at the Henley high-voltage laboratories which is described in this issue embodies many advanced features, some of them, we believe, quite new to practice.

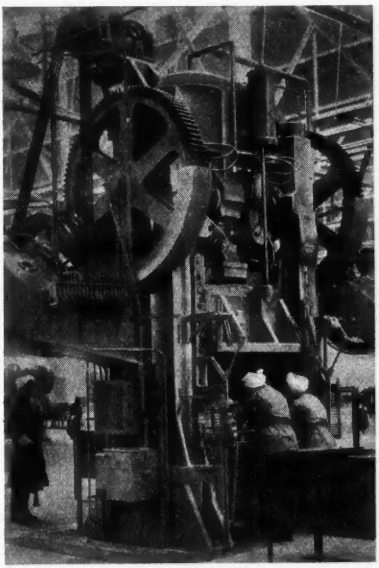
R.O.F. Makes Cookers



New Use for Radway Green Cannon Shell Factory

THOUGH it does not indicate that the Government is anticipating its powers under the Electricity Bill, the entry of the Royal Ordnance Factories into the domestic electrical appliance manufacturing business is an innovation of some note. The step has been taken for the dual purpose of relieving certain serious shortages and of providing work for displaced employees. There is no question of entering into competition with existing manufacturers and all products are being made in accordance with contracts with well-known electrical companies which have not at the moment production capacity available to undertake the work themselves. All the marketing arrangements will be carried out by the companies concerned.

Except for ceramic manufacture undertaken at the Swynnerton and Poole Factories, production of the electrical appliances is confined to a five-acre section of the Radway Green Factory, Crewe. Here, until about a year ago, was what was reputed to be the largest establishment of its kind in Europe engaged entirely in making 20-mm cannon shells and fuzes. As soon as the change-over to its new peacetime uses was decided upon in March last year, the whole of the war plant was removed in the remarkably short time of three weeks. Within seven months production of electric cookers had been commenced and will before long reach one thousand a week. By the summer electric refrigerators for Government housing schemes will also be in production.



250-ton press forming grill chamber door panels

Describing the conversion arrangements, the superintendent of the factory told us that the necessary plant was assembled from surplus R.O.F. stores, conveyors previously used for making shells and presses for jerricans being among the equipment utilized. To start with, the main effort was to get a vitreous enamelling plant into operation. A pilot plant, comprising two 240-kW G.W.B. double ovens previously used in another part of the factory for annealing brass strip, was installed and was in operation within four months. Enamel spraying booths and drying tunnels were designed and constructed by the factory's own staff. By December all the

presses, guillotines, drilling machines, lathes, welding plant, etc., had been installed, despite the fact that the roof had to be removed and replaced to accommodate twelve 250-ton Bliss presses. As the cooker, which is being made for Falco Electrical Appliances, Ltd., of Colebrookdale, Staffs, is of an entirely new design all the necessary jigs and tools had also to be designed and made before production could start.

As the vitreous enamelling plant already mentioned is not of sufficient capacity to deal with the output anticipated, a large new continuous unit is now being installed and will be in operation shortly. Also in hand at the moment is the provision of spraying booths and infra-red drying plant for the refrigerators which are to be made on behalf of the Pressed Steel Co.

Although favourably placed for obtaining ceramic components from Swynnerton, the factory enjoys no preference in the matter of other materials, and is on just the same footing as other manufacturers in regard to the allocation of supplies and, of course, started off with no stocks of any kind. Production is, however, beginning to get into its stride and when all the plant is in full operation will mount rapidly towards its target figure of one cooker every 2½ minutes.

A flow system of production provides for the raw materials to enter at one end of the works and for the finished products to pass out at the other, 1,200 ft away. Sheet steel construction has been adopted throughout for the cookers. The various-gauge sheets 6 ft by 3 ft on arrival at the factory are stacked and distributed as required by means of a 2-ton fork lifting truck. Cut by guillotines to the required sizes, they are pressed, folded, formed and bent according to the components into which they are to be made. Several special jigs have been constructed to ensure accurate drilling in such items as oven and grill compartments, doors and oven door frames. For the latter an arrangement comprising three individually motor-driven drills ensures simultaneous alignment of all holes. Special jigs are also used extensively in the next process, welding and for such components as the grill chambers and outer ovens gun welders have been adopted to "tack" the sections together before they are spot welded.

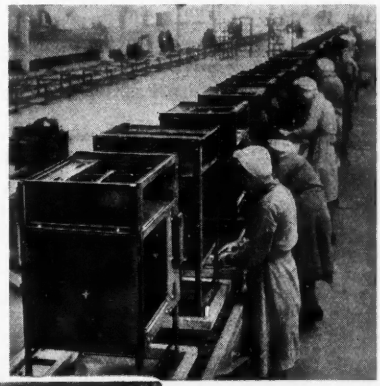
This special jig enables all the holes in the oven doors to be drilled in one operation

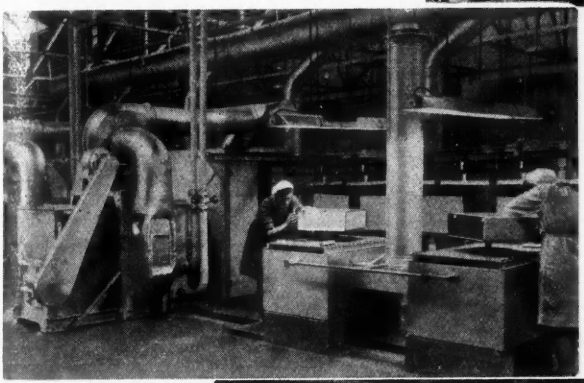
Dipping grill chambers, etc., in vitreous enamel

After fabrication, all the pressings go to pickling vats for degreasing, followed by a thorough drying in a hot-air compartment. The various items are then classified for vitreous enamelling or stove painting. The hobs, oven interior, doors, side panels, grill chambers, lagging sheets, splash plates, etc., are all stove enamelled and only the chassis, back sheet and pan drawer are stove painted, the latter process involving firing at a temperature of 140 deg C for about 30 min. For the vitreous enamelling, the articles leaving the pickling tanks are first dipped in a grip coat. After draining they are passed on by means of a slow-moving conveyor through a drying tunnel equipped with two Sturtevant

hot-air fans. After firing for 5 min at a temperature of 900 deg C they receive their colour coating, again pass through the dryer and on to the brushing tables where the colour coating is removed from those portions where for decorative reasons the black of the grip coating is preferable. A second firing for 5 min at a temperature of 800 deg C completes the enamelling process and after inspection the components go to store, whence they are drawn as required to make up various sub-assemblies.

In the sub-assembly departments are built up the oven and grill doors, grill-boilers, hot-plates, oven elements, fuse mountings, porcelain terminal blocks, etc. Grill-boiler and oven element coils are also wound here.



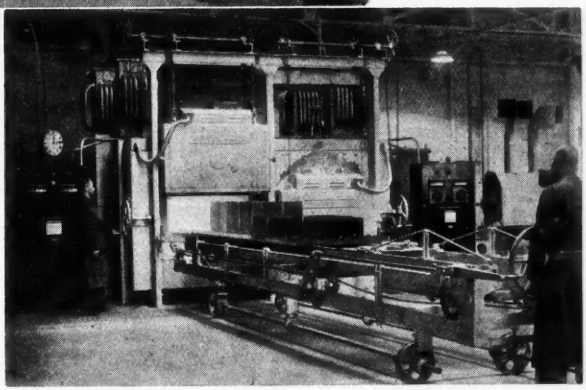


The final assembly line comprises a 3-ft wide conveyor 200 ft long, split into duplicate self-contained halves

bins running along the full length of the conveyor behind the assemblers.

Assembly starts with the fittings of the legs to the inner and outer oven, followed by the packing with slag wool. The switch mounting panel, thermostatic control and switches,

The brushing tables with hot-air dryer in the background and (right) one of the twin electric ovens employed in vitreous enamelling



The final assembly line comprises a 3 ft wide conveyor 200 ft long, split into duplicate self-contained halves. Each half accommodates twenty cookers in various stages of construction. When production is in full swing the conveyor will be set to move at the rate of one station every 5 mins, thus giving one cooker every 2½ min. All the necessary sub-assemblies and other components required for the assembly are ready at hand in steel

porcelain terminal blocks, socket plates and fuses are then added. After the wiring has been completed, the oven door is bedded in

and the cover panel, knobs and grill chamber are fitted. With the addition of the pan drawer, hot-plates, grill-boiler and the two sides of the cooker the apparatus is ready for testing (including a 1,500-V flash test), packing and dispatch.

Throughout the works the various shops have been specially painted in a modern colour scheme which has been proved to result in less fatigue and eyestrain. The outlining of all moving parts also reduces the risk of accidents. No clothes or food are allowed inside the factory, the air-raid shelters having been adapted to serve as cloakrooms and for use during the short meal breaks.

NEW BOOKS

Stainless and Heat-resisting Steels. By E. Gregory and E. N. Simons. Pp. 131; figs. 29; index. Hutchinson & Co. (Publishers), Ltd., Ireland Yard, London, E.C.4. Price 8s. 6d.

This book, of pocket size, represents a dual effort at compression of the maximum possible into small space with as much simplification as the authors have dared. They have not attempted an exhaustive compilation, but rather the classification of a subject that is highly technical and sometimes abstruse. They have succeeded, as before, in providing a simply written account which the student layman will find easy to digest. The task could only have been undertaken with any assurance of accuracy by the chief metallurgist to one of the largest British makers of these kinds of steel.

Commercial methods of manufacture are briefly outlined and the various types of these steels carefully classified from the metallurgical point of view; other chapters deal with machining, welding, heat treatment, hot and cold working, etc., with two subsidiary sections on "stainless-clad" steels and castings, concluding with notes on testing and inspection.—W. O. F.

Practical Plastics. Edited by Paul J. Smith. Pp. 320; illus.; index. Odhams Press, Ltd., 24, Henrietta Street, Covent Garden, London, W.C.2. Price 10s. 6d.

This compendium of information on every aspect of plastics technology by thirteen specialists is a well-produced and well-illustrated book. The publishers say it is "primarily intended for those who are already engaged in one of the many branches of the plastics industry." Without doubt this is a book which justifies its claim to be a "clear and comprehensive guide to the principles and practice of modern plastics."

The editor begins with an "Introduction to Plastics" and ends with a glossary of terms. He also contributes a well-balanced survey of "Plastics in Industry," in something over 8,000 words. His team of specialists deals with subjects ranging from "World Developments" to the chemical structure of organic compounds. It would be invidious to single out particular sections, but such a risk must be taken in welcoming the frank and well reasoned statement of Mr. J. H. Collins on the definition of plastics, which the Institute of the Plastics Industry might well use as the basis of a discussion to ensure the expression and consideration of conflicting views.

Apart from "Laminated Plastics" and "Densified Woods," individual materials are not accorded a separate chapter, this treatment being given to matters of general interest such as properties, test methods, standardization, mould design and production, moulding and radio-frequency heating. Two chapters cover "The Range of Plastics" and "Manufacture of Synthetic Resins and Moulding Materials," while the production and use of thermo-plastic sheet material takes up two more. A final chapter on "Opportunities in the Plastics Industry" completely answers the inquirer who wishes to know how to become initiated.

—W.D.O.

Cold Storage Operation. By A. E. Miller. Pp. 72. "Modern Refrigeration," Empire House, St. Martin's-le-Grand, London, E.C.1. Price 7s. 6d.

This booklet is the first of a technical series of instructional monographs published on behalf of the Institute of Refrigeration. It is concerned with the organization and management of systems of receiving perishable foodstuffs into, and their removal from, refrigerated warehouses, including transporting equipment and methods of packing different kinds of produce into the cold chambers. Actually this booklet does no more than summarize the fundamental "rules" of good procedure, but it might well form the basis of a Code of Practice, the need for which is well recognized.

—W.O.F.

Books Received

Test Papers and Solutions on Electrical Engineering. By T. F. Wall. Pp. 312; figs. and index. George Newnes, Ltd., Tower House, Southampton St., London, W.C.2. Price 25s.

Fault Localizing and Testing on Electric Mains. By F. C. Raphael and C. A. Grover. Pp. 364; figs. 149; index. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, Kingsway, London, W.C.2. Price 20s.

Impulse-Testing Plant

New 1,200-kV Equipment at Henley's High-Voltage Laboratory

In June, 1939, we described the redesigned high-voltage laboratory at Gravesend of W. T. Henley's Telegraph Works Co., Ltd., which had just been equipped with 300-kV single-phase and 125-kV three-phase power-frequency testing plant. Last week we were afforded an opportunity of inspecting there a 1,200-kV impulse-testing installation, which is believed to be the only one of its kind installed in this country expressly for high-voltage cable development. This new plant comprises a 200-kV d.c. charging unit, a seven-stage condenser, a capacity potential divider and a high-speed cathode-ray oscillograph.

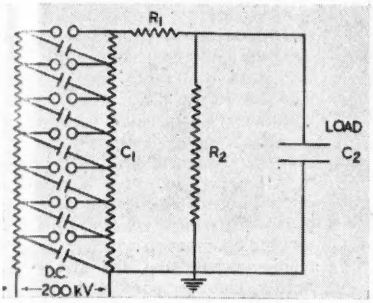


Fig. 1.—Schematic diagram of condenser circuit

The first part of the charging unit consists of a 6-kVA, 80-kV transformer (the core of which operates at half of the output potential) fed from the 50-cycle supply through a 10-kVA, 0-250-V moving-coil regulator. The top plate of the transformer is connected to an oil immersed porcelain-clad 0·015 μF condenser rated at 100 kV d.c. From this condenser the supply is taken through a resistance to the mid point of a pair of oil-immersed porcelain-clad selenium rectifiers, each of 200-kV reverse peak and capable of giving 5mA continuously or 20mA for an hour. Either positive or negative d.c. is obtainable by connecting to the top or bottom of the bank and earthing the opposite end.

The output goes to the first stage of the condenser through a resistance; the latter is earthed when the transformer is de-energized by means of a movable rod, which is automatically disconnected under working conditions by a copper-disc motor. The four-column condenser, made up of alternate 0·0875 μF capacitors and insulators, has its front and back columns permanently paralleled by spark-gap supports, giving a capacity of 0·175 μF per stage. The output of the seven stages in series, each energized at 167 kV, is 17 kW sec.

Charging is accomplished through sloping resistors connecting the two front columns together and the two back columns together; the rear resistors also control the wave tail. Discharging is through hemispherical 150-mm gaps between the front and back columns. One-half of these are fixed as required, and the others are geared to a motor-driven insulated vertical rod, which allows latitude

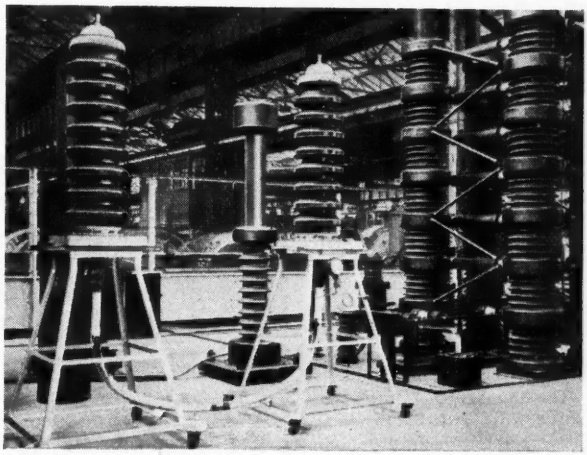


Fig. 2.—Complete impulse plant showing capacity potential divider and 132-kV cable sample

in alignment. The same motor operates a Selsyn system to indicate the gap settings to the control room. Most of the gap circuits include damping resistances, which also form part of the wave-front control, the main part of which is provided by a wire-wound resistance connecting the condenser to the sample on test, which at the time of our visit was a section of 132-kV single-core gas-cushion cable.

Voltage is measured by the capacity potential divider, which is made up of two condenser units in series (mounted on a steel base with rollers) each capable of withstanding 600 kV (peak) and having a capacity of 60 $\mu\mu$F. In the base is a screened low-voltage element and a recording cable matching resistor, and from it a low-capacity cable is taken to the cathode-ray oscillograph.

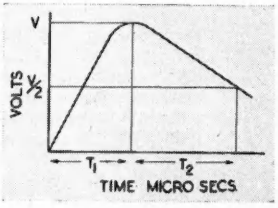


Fig. 3.—Time conditions related to Fig. 1, where $T_1 = R_1 C_2$ and $T_2 = 0{\cdot}7 (C_1 + C_2) R_2$

For tripping the main condenser two motor-driven three-electrode gaps with Selsyn remote indication, two condensers with stabilizing resistors and a transformer of suitable wave form and incorporating anti-oscillatory damping windings are employed. The transformer injects up to 30-kV into the common electrode of the first two gaps and initiates the starting of the generator. Two vertical condensers connected across the gaps give the correct potentials to the electrodes for positive operation in sequence immediately the balance is upset by the injected voltage. The initiating cable for the cathode-ray oscillograph is taken from a tapped wire-wound resistor connected between one hemisphere and the base of the lower condenser. For the purpose of measuring the voltage on the first stage, oil-immersed 100-kV 200-megohm resistors in series to earth, via a d.c. micro-ammeter reading mean kV, are connected in parallel with the tripping condensers.

The impulse generator is controlled from a desk situated in the laboratory control room. Instruments indicate low-voltage input, mean stage kV and main- and auxiliary-gap settings. Push-buttons energize the tripping transformer, causing the generator to function, and operate the isolator, main contactor, moving-coil regulator and the two gap motors. A Castell switch and a relay prevent the energizing of the plant unless the input switchgear cubicle and the control pedestal are closed and locked. An additional electrical interlock which is provided in the supply cubicle cuts off current to the overhead crane if it nears the impulse plant when alive.

Alongside the control desk is the cathode-ray oscillograph, which was designed and constructed entirely in the Henley laboratories. It is fed from a 40-kV d.c. supply and is continuously evacuated by a rotary backing pump and a mercury diffusion pump. The main tube, 5 ft long, is in three sections—a discharge tube fitted with preanode electro-magnetic concentration, a tapping chamber to which is fitted a main concentrating coil and a deflection chamber containing the two pairs of plates and the surge-recording mechanism. The trapping and timing circuits are arranged on one side of the trapping chamber and the whole equipment is in an aluminium screen. Mumetal screens are also inserted in the main tube.

The controls for the oscillograph are housed in an adjoining cabinet, together with the power pack for supplying the timing

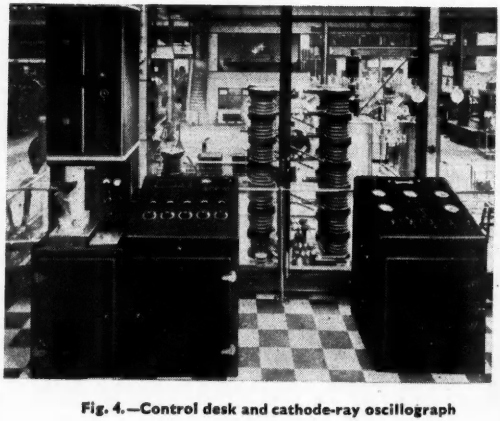


Fig. 4.—Control desk and cathode-ray oscillograph

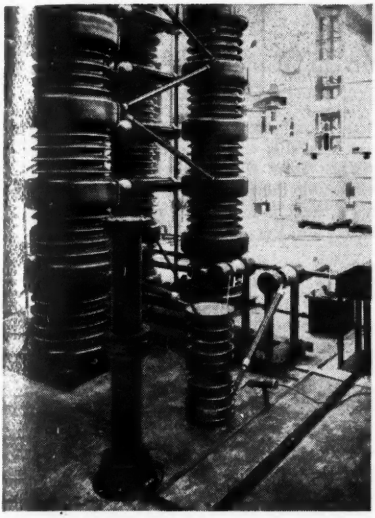


Fig. 5.—Base of condenser bank and controller tripping mechanism

circuits and for calibration and the oscillator for producing the timing oscillations. Waves from the impulse generator are visible through two ports and the fluorescent screen can be moved for photographic recording.

Another recently installed plant permits the continuous application of d.c. to high-voltage cable systems. It is an assembly of condensers, rectifiers, transformers with moving-coil regulator (the last three interchangeable with similar units of the impulse plant) all mounted on a trailer with a control cubicle. Its output at 400 kV d.c. is 5mA continuously or 20mA for an hour; at 200 kV these figures are doubled. Energy is fed to the transformer, in the same way as for the impulse plant, and thence to a 200-kV condenser, passing on to four 200-kV oil-immersed metal rectifiers arranged in pairs. The set has been used for testing 132-kV cable installed by the company for the Central Electricity Board. The impulse generator and the portable d.c. unit were manufactured by Ferranti, Ltd.

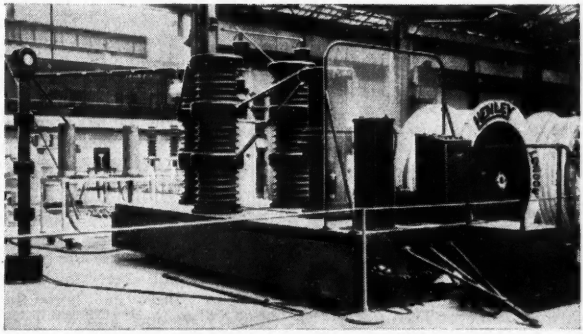


Fig. 6.—400-kV d.c. transportable testing set

We took advantage of the occasion to go round the adjoining Engineering Department factory which, brought into use early in the war for munitions manufacture, has now been converted to its intended purpose of producing distribution equipment. Our thanks are due to Mr. W. C. Barry, Henley's research manager, and to Mr. T. R. P. Harrison, chief engineer of the high-voltage research and testing laboratories, for the information on which this article is based.

Hire-Purchase in South Africa

ALTHOUGH the chairman of the Cape Town Electricity and Waterworks Committee expressed the view that the Council should not return to that form of municipal trading, it was recently decided to revive the scheme for the sale of electrical appliances on the hire-purchase system. The Committee chairman contended that while the scheme was quite rightly undertaken years ago when the Council started the "Cook by Wire" publicity campaign which achieved splendid results, to-day the position had altered radically. In peak periods the load was as heavy as could be carried, and extensions to the power station were being hurried forward. Furthermore, women no longer had to be converted to the advantages of electricity; a new generation had grown up which would consider the use of nothing else. Most important of all, firms had such long waiting lists that everything that came to hand was disposed of quickly, and if it were not for building restrictions the demand would be even greater. He added that the showrooms were so much waste of space at present—they had nothing to sell—and their conversion into offices was highly desirable.

Views on the News

Reflections on Current Topics

IN announcing last week that he proposed to give permission for the erection of the Bankside power station, Mr. Silkin said that he was proceeding on the basis that there would be no injurious effect from sulphur fumes to the structure of St. Paul's. This additional safeguard did not, of course, satisfy the opposition, which contests the use of the site at all. On this point Mr. Silkin made it clear that, deprived of the site, Greater London would be short of electricity owing to the limited alternatives. I cannot see any justification for the contention that the Government has acted in a panicky way in making its admittedly difficult decision. It is to be hoped that the fulfilment of the scheme will not be further impeded for it is essential to increase the country's generating plant capacity.

* * *

Granted that the present deficiency in power for industry has to be made good at almost any price and that oil in certain circumstances possesses some advantages as a fuel, it has been disturbing to hear of late airy references to oil, which has to be imported, as an alternative to coal for the production of electricity. Apart from expenditure of labour and material in conversion of existing combustion arrangements, there is the serious consideration that, after allowing for a B.Th.U. content per lb half as much again as that of coal, the higher price of oil per ton in the London area would result in an increase in fuel costs per kWh generated by some two-thirds. Fuel costs now form more than 75 per cent of the works expenses of generation and nearly 30 per cent of the total supply costs excluding capital charges.

* * *

In a letter to *The Times* Mr. A. H. Holden deals with the endeavours of the Ministry of Fuel and Power not only to keep up with ever-changing temperatures but to decide which parts of Great Britain are the coldest. Special concessions have been made to North Britain (which includes Scotland) in the way of extra coal allocations and later application of the space-heating ban. Yet, says Mr. Holden, records show that throughout the recent severe winter and again during early May (except for a portion of the North-East Coast) temperatures were higher in the north than in the south. I am afraid that even this will not prevent the Ministry's officials from flying in the face of nature; they have their ideas on the subject which share the characteristics of the laws of the Medes and Persians.

* * *

So much was owed to the Servo Panel set up by the Ministry of Supply during the war that the interest shown by the present Minister in the I.E.E. Convention last week was most appropriate. Mr. Wilmot left one in no doubt that he fully appreciates the great potentialities of servo mechanisms for industrial processes in peace as well as in war. The interest of electrical men was seen vastly to transcend the bounds of the Measurements Section (of which Mr. L. J. Matthews is chairman) which was responsible for the Convention and on the opening night Mr. de Ferranti presided over a gathering that rivalled in numbers even the attendance at his own inaugural address.

* * *

Although scarcity of glass still prevents restoration of natural lighting in factories, complete reglazing is not necessary before a great deal of the electricity consumed on that account can be saved. A 15 per cent replacement will often make all the difference. Sometimes window glass is obscured by paint which it has been found impossible to remove by the methods tried. It is pointed out in *Fuel Efficiency News*, however, that no coating of this kind has been met that is proof against an appropriate solvent.

* * *

What is the proper point for an inauguration ceremony? For hundreds of years there has been the laying of foundation stones and the practice of cutting the first sod has grown up. Recently I noticed from the *Electrical Review* that the Countess of Airlie launched the Tummel-Garry hydro-electric scheme by setting a concrete mixer in motion. But they went one better at Edinburgh where the big modernization at the Portobello station was inaugurated by the loosening of a nut on a 25-year-old turbine which is to be replaced.

—REFLECTOR.

Electricity Bill

Dissipation of Assets : Non-Statutory Undertakings

THE remaining Clauses of the Electricity Bill were quickly agreed to when Standing Committee E of the House of Commons met last week.

Mr. Westwood, Secretary of State for Scotland, moved a new clause to enable a statutory review to take place before 1953 (the date by which the North of Scotland Board would have been in existence for ten years) of the guaranteed price arrangements under the 1943 Act. He reminded the Committee that this Act provided that surplus electricity sold by the North of Scotland Hydro-Electric Board to the Central Board was to be paid for on the basis of the cost of producing a similar amount at the most economical steam station controlled by the Central Board, on the assumption that the coal used at that station was bought at the price ruling in Central Scotland.

The clause was carried by 19 votes to 11.

Restrictions on Companies

Sir Arnold Gridley moved a new clause to provide that where companies were concerned they must carry on until the vesting date their undertakings in the ordinary course of business and must maintain them as efficiently as before. In addition, they should not, without the Minister's consent, or the approval of the Electricity Commissioners, (*a*) sell, dispose of or let for a longer period than one year any of their lands or sell or dispose of their investments; (*b*) apply any funds otherwise than for the purposes for which those funds were used respectively up to January 10th, 1947; (*c*) enter into any contract of any kind extending beyond the period of one year; (*d*) borrow any money or issue any securities; or (*e*) undertake any project involving the construction of new works at a greater estimated cost than £50,000.

Sub-section (2) of the clause (said Sir Arnold) provided that if, unhappily—and he thought it extremely unlikely—there should be any contravention of those instructions, and any Area Board which felt itself aggrieved was able to claim compensation against the offending company, damages would have to come out of the compensation which would otherwise fall for distribution among the shareholders of the company. The provisions of the new clause followed very closely similar provisions in the Transport Bill, and the wording was very similar to sections in existing Acts which gave statutory approval to purchases of electricity undertakings or to the amalgamation of electricity undertakings.

Mr. Gaitskell, Parliamentary Secretary to the Ministry of Fuel and Power, said that the clause did not go far enough in safeguarding the position. For example, it did not deal at all with such transactions as the disposal of plant or stores for inadequate considerations. Nor did it deal with the acquisition of property at exorbitant prices or take into consideration short-term contracts. Clause 25 of the Bill, after the amendments which the Government proposed to make, would be quite sufficiently tempered so that it would not be likely to have any deleterious effect.

On this understanding, Sir Arnold Gridley withdrew his clause.

Mr. Foster moved a new clause to protect the interests of non-statutory undertakers under which these undertakers could require an Area Board to acquire their undertakings on agreed or arbitrated terms. He said that there were over 300 non-statutory undertakers in the country. He was sure the Minister would agree that that would be a serious matter for these undertakings if they had to close down.

Mr. Shinwell, Minister of Fuel and Power, said that he would not dispute the contention that competition from the major undertakings might be so severe that non-statutory undertakings might be driven out of business. There was undoubtedly an element of unfairness in that. He promised to consider the introduction, on report, of a new clause which would not, however, go so far as Mr. Foster wished. He was not committed to the actual wording at the moment, but it might mean that a non-statutory undertaker who, after a particular date, had incurred capital expenditure on works that were necessary to develop or to provide a supply of electricity in the area might, with the Minister's approval, within a stated period, serve notice on the appropriate Board asking that the undertaking should be acquired on terms to be agreed upon, or settled by arbitration.

On this assurance, Mr. Foster withdrew his clause.

Approval of Station Design

Viscount Hinchingbrooke moved a new clause to provide that before deciding either on the site, elevation or building material of a new generating station the Central Authority should consult the Royal Fine Art Commission. He instanced the case of Bankside in support of his argument.

Mr. Shinwell pointed out that the Electricity Commissioners already consulted the Royal Fine Art Commission on matters of design, but not of siting, which involved strategic and economic considerations which were not matters primarily for the Royal Fine Art Commission. He gave the assurance that the Minister would direct the new Authority to consult with the Commission on questions of design.

The clause was withdrawn.

The Committee stage was concluded on Thursday last week, the day before Parliament rose for the Whitsuntide Recess.

On the Second Schedule Mr. Gaitskell moved an amendment to meet a point which had been raised in Clause 1 by Sir Arnold Gridley, who had expressed anxiety that, by reason of the words: "standardization of supply and types of electrical fittings," there might be a tendency for the boards to impose types of fittings upon consumers in an autocratic manner. Section 18 of the Electricity (Supply) Act, 1882, said Mr. Gaitskell, forbade undertakers to prescribe a special form of lamp or burner, and generally safeguarded consumers who used those lamps or burners from being dictated to. The Ministry felt that if it were to introduce the words "electrical fittings" in place of the words "lamp or burner" it would give the desired protection to the consumer. The amendment was agreed to.

Issue of Stock

Mr. W. G. Hall, the Financial Secretary to the Treasury, moved a long and complicated new schedule dealing with the issue of British Electricity stock in satisfaction of compensation. He explained that, under Clause 17, as amended, and under this Schedule, it had been agreed that the holders of quoted securities should be able to exercise their rights to enjoy full ownership and control of the new British Electricity stock as from the vesting date, instead of the date of actual issue. The effect of that would be that they would know on the vesting date, although the actual new stock would not be in their hands, exactly what the compensation was, and what the value of their particular holding was, and notionally they would hold British Electricity stock. On the vesting date the Treasury would determine the value of British Electricity stock to be issued as compensation, so that it would be equal in value to the quoted securities of the bodies taken over, having regard to the rate of interest, the date of redemption and the premium or discount, as the case might be, of issues at that time. That determination would fix the nominal amount of British Electricity stock, and quoted securities would be valued accordingly, and could be dealt with on the Stock Exchange at that date. Holders of those quoted securities would be invited to surrender them—not all at once, but section by section, in order that the new stock could be issued in exchange, and if they were sold the purchaser would get a new British Electricity stock certificate, whether for a particular piece of stock that had gone round or not, to transfer into new stock. The interest on the British Electricity stock was to accrue from the vesting date.

Some difficulty might arise when they came to unquoted stock, because, to begin with at any rate, they would not know what the actual value of the compensation was. In this case the estimated value of the interest would be issued from time to time, and later, when the actual value of the security had been fixed, probably by arbitration, the balance of the interest would be made good.

The new schedule was agreed to, and the Committee stage concluded.

Mr. Shinwell said that he had to commend the members on both sides who had done all they could to facilitate the passage of the Bill. There had been nothing in the nature of obstruction. In spite of the most careful drafting, said the minister, the Bill presented considerable difficulties.

PARLIAMENTARY NEWS

By Our Special Reporter

IN the House of Commons on May 22nd Sir Stafford Cripps said that the value of electrical generators of more than 200 kW capacity exported during January, February, March and April, 1947, totalled respectively £402,212, £437,241, £166,524 and £692,239. It would not be practicable to divert current export orders to home use but arrangements had been made to give preference to orders for home power plants. The plant exported was not suitable for the home market and had been made for export orders. In reply to a question by Mr. York as to whether the export of those amounts of equipment was holding up the erection of any plant in this country, Sir Stafford said that on the contrary they were in fact expediting it, because they were clearing factories of export orders to make them available for others.

Sir George Jeffreys asked the Minister of Fuel and Power whether his attention had been drawn to the fact that the system of generation close to the coal mines had been successfully operated in New Zealand for a considerable time; if he had considered carrying power by means of the grid to London and elsewhere; and if he would try this cheaper and more convenient method of providing power for London than the proposed new generating station.

Mr. Shinwell said that the answer to the first part was no. He understood that the principal source of supply of electricity in New Zealand was water power. The question of generation at coalfields in Great Britain had, however, by no means been overlooked. He was advised that it was more economical at present to transport coal to London and the

South Coast by sea than it would be to transmit electrical energy from the coalfields supplying these areas.

The Bankside Scheme

Having considered the whole matter in the light of discussions in the House of Lords and in public the Government feels obliged to adhere to its decision to approve the scheme for the erection of a new generating station at Bankside. Announcing this, Mr. Silkin said that he accordingly proposed to give consent to the erection of the power station subject to the conditions he had laid down. He gave an assurance that before the scheme went forward he would satisfy himself that sulphur fumes from the station would be dealt with in such a way that they would not endanger St. Paul's.

Mr. Silkin was convinced that the erection of the power station would in no way injure the amenities of the area and would in no sense prevent the proper development of the south bank. The House should consider the utilitarian aspect of the matter. Up to 1951 we should require an increase of 67 per cent of the existing quantity of electricity. Between 1951 and 1960 we should have to double our output. The number of alternative sites was strictly limited. A large number of additional sites would be required in the next few years and every available one would be needed for the purpose.

If they were deprived of the Bankside station the Greater London area would be short of 240,000 kW and this must mean that electricity would be shut off more frequently. He believed the House and the country as a whole were in favour of the decision.

Mr. Shinwell said that on the basis of oil at £6 per ton and coal at £2 10s. a ton, the additional cost of using oil instead of coal in the new Bankside power station was estimated to be between £400,000 and £500,000 per annum, thus increasing the cost of electricity generated by about one-third.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

C.M.R. Electric Motors

IN your editorial of May 16th commenting on the I.E.E. paper "The Electrical Installation in a Viscose Rayon Factory" by Messrs. C. F. Freeman, B.Sc. (Eng.), M.I.E.E. and H. V. Mather (of Courtaulds, Ltd.) you drew attention to the excellent power factor obtained in their system layout due to the care taken in matching approximately six hundred motors to load requirements.

It is interesting to note that the motors used were totally enclosed fan cooled machines which have no sustained overload capacity. This installation therefore is another example of continuous maximum rating motors being adequate to industrial requirements. Moreover, as the horse-power available from such motors corresponds closely with load demands the power factor of the complete installation is automatically higher than if motors with an unnecessary margin of H.P. had been used; such, for example, as B.S. protected type motors.

*London, S.W.*1. A. N. D. KERR, A.M.I.E.E.

Cost of Living Index

THE leading article on "Wages and Hours" in your issue of May 16th rightly points out the difficulty of assessing the justice of claims for increased wages in view of the fact that the available official statistics are rather difficult to apply to any particular case. This is particularly true of the present actual cost of living as distinct from the now officially discredited Cost of Living Index. The Board of Trade issue monthly statistics of the percentage changes in wholesale prices of 200 commodities or commodity groups, and the present figure is about 80 per cent above 1939 levels. While it is true that the individual's cost of living is governed by retail and not wholesale prices, I think it will be generally conceded that any increase in wholesale price of any commodity will be passed on in full and without undue delay to the final consumer.

Monthly statistics issued by the Ministry of Labour show that the increases in wage rates in all industries have risen almost uniformly since 1939 to a present figure of 65 per cent above 1939 levels, and in your leader referred to above you quote 62 per cent as being the increase above 1938 levels in the electricity supply industry. In the same issue of your journal a correspondent "Charge Engineer" comments on the incidence of the Cost of Living Index on the salaries paid to the technical staffs in the industry.

A charge engineer in a Class H station (50,000–100,000 kW capacity) has had a salary increase of approximately 30 per cent above 1939 figures, and approximately 13 per

cent of this only about a year ago. From these figures it will be seen that the technical staff in the industry has had a very poor deal since 1939, and many are feeling real hardship in making financial ends meet.

I cannot agree with your correspondent's view that a 30 per cent increase in present salary rates would "rectify" the situation—it would only partly alleviate it. From the present Board of Trade figures present-day prices are 80 per cent above 1939 levels, so that even a 40 per cent increase in the present salary of a Class H charge engineer instanced above will only bring him up to the actual cost of living level for a month or two—it will not compensate him at all for the increasing loss each year since 1939, and as the true cost of living is at present increasing at an accelerated rate, he will commence to fall again to his present deplorable financial position.

C.O.L. INDEX VICTIM.

Earthing Conductors

WITH regard to "Pro Bono Publico's" query on earthing conductors in your issue of May 23rd, providing the earth wire gives positive continuity for apparatus with flexible conduit connection, it does not appear to be critical as to internal or external placing, but the difficulties encountered when bringing the ends out if placed internally support external application of the wire.

*London, S.E.*24. A. M. JONES.

Registration of Contractors

CREDIT is due to those gentlemen who have done so much to raise the standard of installation work but whose efforts, I am afraid gain little thanks. In twenty years of the Register's existence, the number of contractors enrolled is some 1,200, representing approximately two contractors in each town, city and burgh in Britain, which is not at all satisfactory.

Why the English members of the E.C.A. have withdrawn their support of the Register is difficult to understand. While I fully realize the weakness of the N.R.E.I.C. no good purpose can be achieved by merely saying "It's no good," and showing the white feather by clearing out. After all, the voluntary system is better than nothing and in present conditions and circumstances compulsory registration is unfortunately, not likely to be realized for some considerable time.

I have never hidden my views on this subject and it is still my intention of availing myself of every opportunity to push forward to the goal of compulsory registration. In the meantime, let us give the N.R.E.I.C. all the support in our power.

Glasgow. ALEX. MILNE, SENR.

Quality of Coal

AT the North Western Fuel Luncheon Club at Manchester, Dr. A. Parker (Director of Fuel Research) said that this country's workable coal resources would last for at least 200 years at the present rate of demand. Quality was, however, almost as important as quantity and average ash content to-day was probably 5 per cent higher than in 1938-39. Makers of plant for using or treating coal, and operators, needed more information about grades and qualities of coal likely to be available, which the National Coal Board would no doubt be able to provide in time.

Coal always contained sulphur. At the Battersea and Fulham power stations most of the sulphur was removed from the chimney gases before discharging them into the atmosphere, at a cost of between 5s. and 7s. 6d. per ton of coal burnt, although the coals used contained no more than 1 per cent of sulphur. The difficulties experienced would be increased and costs raised with higher proportions of sulphur.

Boilers at some stations had to be shut down for cleaning after less than 1,000 hours' operation owing to the deposition of solid matter on the heating surfaces, tubes, superheaters and economizers and there was often serious corrosion of air heaters. Boiler availability could be more important even than boiler efficiency.

Electricity Supply Loans

STATISTICS published by the Electricity Commissioners of loans sanctioned to electricity supply authorities during the year ended March 31st, 1947, reflect a considerable acceleration of activity. The total value of loans at £43,978,594 is £6,326,219 more than for the previous year, and while loans for generating plant increased only slightly, from £19,077,935 to £19,239,336, the figure for mains and services rose from £3,667,759 to £8,299,475 and that for distribution plant from £2,381,948 to £4,854,982. There was a decline from £10,710,085 to £6,799,906 in loans for buildings for generating purposes, other figures being: property £322,556 (£124,165), distribution buildings £1,618,303 (£789,258), meters and instruments £679,128 (£246,418), wiring installations £80,017 (£16,009), apparatus £594,788 (£245,500) and "other purposes" £1,490,103 (£393,298).

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE principal guest at the Convention banquet of the I.M.E.A. at Bournemouth on June 26th is to be **Professor J. D. Cockcroft**, C.B.E., F.R.S.

Mr. W. P. Lilwall, who is retiring from the Council of the Incorporated Municipal Electrical Association upon his retirement from the position of borough electrical engineer of Fleetwood, has been elected an honorary member of the Association of which he was president in 1944-45.

Mr. H. Coope, M.I.E.E., district manager for the South Wales and West of England Area of the Metropolitan-Vickers Electrical Co., will have completed twenty-five years in this capacity and forty-five years with the company on Monday next, including his service with the Westinghouse Electric Co. To mark the occasion a private luncheon is to be held and a presentation will be made. Mr. Coope is a past-chairman of the I.E.E. Western Centre, and is a member of the Council of the South Wales Institute of Engineers.

Mr. H. P. Baynham, deputy electrical engineer at Carlisle, wishes to retire in June next. The appointment of a successor is to be left over for a short time, in view of the Electricity Bill, and Mr. Baynham is to continue his work as deputy city electrical engineer from July 2nd at a remuneration which, with his superannuation allowance, will equal his present salary.

Mr. Charles Forsyth, resident engineer at Keswick to the Keswick Electric Light Co., is retiring at the end of this month after forty-seven years' service with the interlinked Windermere and Keswick companies, and thirty-one years at Keswick. The directors have presented him with a gold watch and chain, and the staffs have given him a silver tea service and a salver.

Mr. H. J. Finden, M.I.E.E., who is responsible for development and design of test equipment for the Plessey Co., Ltd., Ilford, is giving a lecture on frequency generation and measurement at the Conference on Instruments and Measurements, Stockholm, which is being held from June 4th to 7th, arranged under the auspices of the Royal Swedish Academy of Engineering Sciences and the Association of Technical Physicists.

Mr. T. W. Royle, a vice-president of the L.M.S. Railway, has been elected president of the Institute of Transport for the year 1947-48. He will take office on October 1st next.

Mr. J. M. Arnott, of the Stockton-on-Tees Corporation Meter Department, has been appointed meter superintendent to the Lowestoft Corporation.

Mr. A. Apps, managing director of S. W. Bligh, Ltd., electrical contractors, Canterbury, has been elected chairman of the East Kent Branch of the Electrical Contractors' Association.

Mr. R. L. Hearn has been appointed manager and chief engineer of the Hydro-Electric Power Commission of Ontario. He has been in charge of engineering, design and construction. **Dr. O. H. Holden** and **Mr. A. W. Manby** have been appointed assistant managers responsible for engineering and administration respectively.

Mr. R. D. Glass has been elected president of the North of England Branch of the Association of Mining Electrical and Mechanical Engineers in succession to **Mr. J. H. Foster.**

Mr. P. E. Wilson has joined the sales division of George Forrest & Son, Ltd.

Mr. L. H. G. Smith, of Bromley, has been appointed mains assistant with the St. Pancras undertaking at a commencing salary of £565 per annum.

Mr. Herbert Shackleton, M.Sc., M.I.E.E., has been appointed deputy engineer and manager of Rochdale electricity undertaking. Educated at Burnley Grammar School and Manchester University, where he graduated with second-class honours, Mr. Shackleton joined the staff of Manchester Electricity Department, where he served in various capacities until 1944, when he was appointed electro-technical engineer.

Mr. T. B. Nutter, Burnley borough electrical engineer, is to retire on superannuation in August. He has been associated with the Electricity Department for forty-seven years and was appointed to his present position five years ago, when Mr. J. E. Starkie retired.

Mr. C. J. King, B.Sc.(Eng.), A.M.I.E.E., has recently been appointed E.L.M.A. Lighting Service Bureau area engineer in Scotland. Mr. King joined the Bureau staff in London in 1946 after six years' service with the R.E.M.E., in which he attained the rank of major (E.M.E.). He has already done a considerable amount of lecturing to Design Course audiences and taken part in a number of lighting investigations. At the earliest opportunity he intends carrying out extensive alterations to the Glasgow premises.

The directors of Laurence, Scott & Electromotors, Ltd., entertained the Norwich works football team, the " Gothics," and their friends to dinner on May 17th, in celebration of a successful season in which they won the Norfolk Senior Cup at their first attempt and also had creditable records in the F.A. and A.F.A. Cup competitions.

To celebrate the success of its production drive to catch up on losses sustained during the

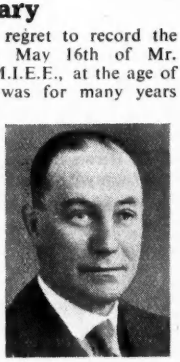
fuel crisis, Hoover, Ltd., held a grand fête at the Perivale factory last Saturday. During the six weeks' " Forward to Prosperity " campaign production was 30 per cent higher than what has hitherto been considered a good normal output and double the pre-war figure.

Mr. F. H. S. Rasch has resigned from the firm of Appleby & Co. (London), Ltd., and has become a director of McKenzie Cade, Ltd., 173, Fleet Street, E.C.4.

Mr. C. Cradock, secretary to the Manchester Corporation Electricity Department, retired on May 21st. He had been in the service of the Department for forty-eight years. At a lunch given in his honour he was presented by Sir William Walker, chairman of the Electricity Committee, with an illuminated address, savings certificates and a personal gift from the Committee members.

Obituary

Mr. H. C. Babb.—We regret to record the death in Edinburgh on May 16th of Mr. Herbert Charles Babb, M.I.E.E., at the age of sixty-eight. Mr. Babb was for many years general manager of the Lothians Electric Power Co. and the Musselburgh and District Electric Light and Traction Co., Ltd., until his retirement in 1944. He received his early training at the Merchant Venturers' Technical College Bristol, and served an apprenticeship with F. W. Ball & Co., Bristol.



The late Mr. H. C. Babb

From 1896 to 1901 he held various posts with electrical contracting firms and he then joined the staff of Edmundsons Electricity Corporation, Ltd. Whilst with this company he carried out plant extensions in Guernsey and in 1902 was appointed chief assistant at its Dartmouth undertaking. In 1913 he was promoted to chief technical assistant at Hawick and in 1915 became engineer and manager of the Bo'ness undertaking of the National Electric Construction Co., Ltd. In 1919 he was appointed manager of the Musselburgh undertaking and in 1922 also took over the management of the Lothians Electric Power Co. which was on the point of commencing operations.

Mr. Babb was a past chairman of the Scottish Centre of the Institution of Electrical Engineers. He was also a member of the Royal Society of Arts, the Association of Supervising Electrical Engineers, the Scottish Road Transport Association, the Association of British Engineers and a founder member of the Institute of Transport. Before retirement he had been a member of the C.E.B. Central Scotland Consultative Committee from its inception. In the 1914-18 war Mr. Babb was an Assistant Coal Controller in Scotland.

Mr. A. Albrecht.—We reported recently the death on May 9th of Mr. A. Albrecht, director and secretary of the Electrical Wholesalers Federation. After leaving school Mr. Albrecht was articled to an architect, but before completion of his articles he joined the St. Marylebone Electricity Department and later went to the Santoni Co., Ltd., as sales manager. Shortly afterwards he commenced operations on his own account as an electrical wholesaler in Newcastle in 1906. In 1918 his firm, the North British Engineering & Equipment Co. joined the E.W.F. and within a very short time Mr. Albrecht was elected to the Council of that body. In 1920 he was elected President and again held this office in 1930, having served on the Council for eleven consecutive years. In 1931, towards the end of his year of office as president, he accepted the duties of secretary, and later became director, an office which he held until his death at the age of sixty-four.

The Electrical Wholesalers' Federation has to thank Mr. Albrecht to a large extent for the position which it enjoys in the industry to-day. When the Fair Trading Council was formed in 1933, he was one of the Federation's representatives and played a great part in the devising of its policy. He also played a prominent part in the radio industry in its early days and was chairman of the N.A.R.M.A.T. in 1926.

Mr. R. C. Brown.—The death has occurred at the age of sixty years of Mr. Ralph C. Brown, director of British Acheson Electrodes, Ltd.

Wills.—Mr. R. N. Vyvyan, of Falmouth, late engineer-in-chief of the Marconi Co. and joint engineer-in-chief of Imperial & International Communications, Ltd. (now Cable & Wireless, Ltd.), who died on December 14th last, left £1,714 gross, with net personalty £1,593.

Mr. G. Casperson, Headingley, Leeds, wholesale electrical factor, who died on September 28th last, left estate " so far as at present can be ascertained " valued at £6,512 gross, with net personalty £6,128.

Mr. James Scott, electrical engineer, partner in James Scott & Co., of Dunfermline, Edinburgh, Glasgow and Perth, who died on September 9th last, left personal estate in England and Scotland valued at £40,626.

Mr. J. E. Pownall, late deputy borough electrical engineer of Tunbridge Wells, left £5,629 (net personalty £3,847).

Mr. H. Ward, managing director of Ward & Co. (Dewsbury), Ltd., left £7,027 (net personalty £4,315).

Mr. W. A. Barnes, late secretary of Reading Electric Supply Co., left £559 (net personalty £522).

Mr. F. J. Blake, electrical engineer and contractor, Kingston-on-Thames, left £5,173 (net personalty £4,927).

Frozen Cooked Meals

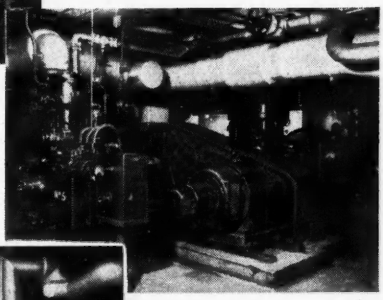
Possibilities for Large-Scale Catering

ON January 10th we described how the blast tunnel quick-freezing process is employed for preservation of fruits and vegetables. A further application of this process adopted by J. Lyons & Co., Ltd., namely the freezing of hot cooked meals, has probably even greater possibilities. For fifteen months "Frood," as the treated dishes are called, has been used regularly on the British South American Airways Corporation services (see May 24th, 1946, issue, page 819) and so successful have been the results that final experiments promise its use in all the company's teashops and also, when the cessation of rationing permits, its sale over the counter for the housewife to use at home.

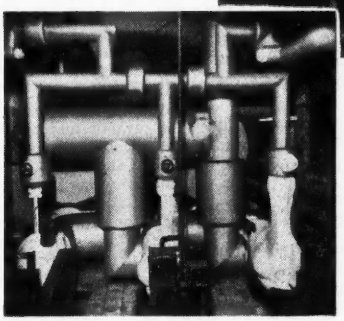
Preparing dishes ready for cooking and quick-freezing

With the process adopted, refrigeration of the freshly cooked food is begun soon after it is cooked while it is still hot. At this stage the product is identical in every respect with meals that have been prepared in the normal fashion. All types of dishes are dealt with by the plant—puddings, pies, vegetables, soups, sweets, etc. No special preparation is required: the food is very carefully cooked in the firm's extensive kitchens and is then ready for the refrigeration process.

The cooked and dished food comes straight from the kitchens in wire trays which are loaded on to a variable-speed conveyor fitted with suspension racks which pass through an L-shaped cold air blast freezing tunnel. The tunnel, which is about 4 ft wide, has approximately 200 ft travel and is supplied with re-circulated air at a temperature of from 0 to 5 deg F. The air is circulated by three specially designed Keith Blackman axial-flow volume fans (each fan dealing with one leg of the tunnel), subsequently passing through a cooling



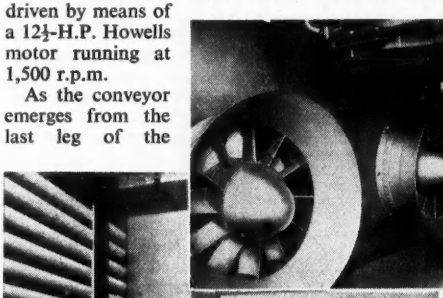
Food entering the freezing tunnel and (right) the ammonia compressor plant



The ammonia room from which pumps circulate the ammonia to the cold room and cooling battery

battery of direct expansion ammonia coils through which it is reduced in temperature for re-circulation. Each fan is vee-belt driven by means of a 12½-H.P. Howells motor running at 1,500 r.p.m.

As the conveyor emerges from the last leg of the tunnel it passes straight into a storage cold-room fitted with ammonia ceiling coils. The temperature of the room is usually 5 to 10 deg F higher than the temperature of the air tunnel. The wire trays are taken off the conveyor carriers in the cold room and placed in portable racks for the double purpose of storage in the room and removing from the food the last few degrees of heat which take a longer period to extract than could be economically effected in the tunnel.



Battery of ammonia coils employed to cool the freezing tunnel

The goods are left in the room for several hours to ensure that they are frozen right through to the centre and the 5,500 sq ft provide ample capacity for this purpose as well as storage for the necessary turnover period.

The whole of the tunnel and cold room is insulated with 6 in. of cork and the ammonia gases are compressed in the main refrigeration engine room. This plant takes approximately half of the output from a 10 in. by 10 in. York Shipley ammonia compressor under normal conditions and the refrigeration system is by re-circulated ammonia. The liquid is circulated through the coil circuits by means of two pumps fitted with 1½-H.P. Brook motors (with a third unit in reserve). There are two circulating systems, one of which serves the cold room while the other is connected with the cooling battery coils.

Three fans circulate the cold air round the freezing tunnel

Although the existing plant is now powered in common with other plant from a 10 in. by 10 in. York Shipley compressor and auxiliaries, arrangements have been made for the whole of the capacity from this compressor to be used for "Frood" when necessary and it is estimated that this unit driven by its 110-H.P. 1,000-r.p.m. Crompton Parkinson motor will be of sufficient capacity to meet all further requirements. The room and tunnel temperatures are checked by Negretti and Zambra's electric multiple point recorders.

It is stated that the output of the plant already in operation is approximately one ton of frozen cooked food per hour, but this will soon be doubled by the completion of a duplicate plant.

Lighting for High-speed Photography

A FLASHING source of light of high intensity for high-speed industrial photography and research purposes is announced by the Mullard Wireless Service Co., Ltd. It is known as the LSD.2 discharge tube, being a development of the original "Arditron"; the flash is of one micro-second duration at 7,500 V and the total integrated light output is of the order of 1,500 lumen-seconds.

The greater part of the useful light is radiated during the first half-cycle of the discharge, the after-glow due to the subsidiary discharge being of relatively low intensity. The tube is filled mainly with argon gas at atmospheric pressure and the electrodes are potassium-activated. The cathode and anode are copper rods while the triggering grid is a copper ring, all accurately aligned and rigidly supported by tungsten wires sealed through the boro-silicate glass envelope.

The tube may be triggered by discharge of a capacitor through a thyratron into the primary winding of a step-up transformer, an oscillatory pulse of some 3,000 V being needed. A useful life of some thousands of flashes may be expected. The tube is intended for single flash operation only and not as a stroboscope lamp.

Repulsion Motors

Characteristics of Different Types

By "Rotor"

A COMMON type of repulsion motor has two stator windings at right angles to each other, one of which acts as an inducing winding to create current in the rotor conductors by transformer action, while the other winding, without transformer action, merely creates a magnetic field on which the rotor currents act to create the torque. The similarity between the series a.c. motor and the repulsion motor will be apparent from Figs. 1 (*a*) and 1·(*b*). In the former the armature current always equals the field current since the two are in series. In the repulsion motor the armature current is proportional to the current in the inducing winding, which is in series with the field winding; its direction of rotation can be changed by reversing the current in either the inducing winding or the field winding, without alteration of brush position. Alternatively the field winding can be arranged as shown in Fig. 2, and the motor controlled and reversed by a single-pole two-way switch.

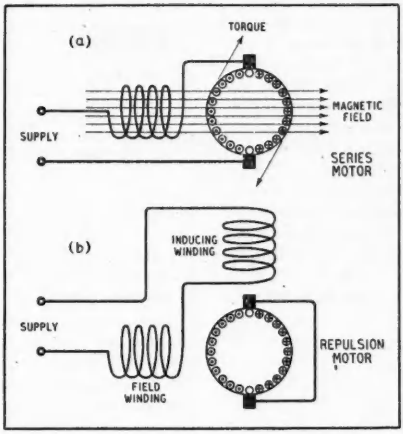


Fig. 1.—Circuits for (a) series motor and (b) repulsion motor having field and inducing windings

Power factor may be improved through the use of "phase-compensated" motors, in which case one set of brushes is short-circuited and placed so that the rotor coils between them embrace maximum stator flux, i.e. the magnetic axis created by the parallel windings due to these brushes corresponds with that of the stator. The other set of brushes (the "excitation brushes") are at right angles to the first set and are either directly connected in series with the stator winding or fed from the secondary of a transformer or auto-transformer, the primary of which is in series with the stator winding (Fig. 3). The rotor winding then acts as a compensating winding to the stator winding, creating a transformer flux, and also as an excitation winding. The leakage magnetic flux, which occurs between the rotor and stator in a simple repulsion motor, is thus eliminated and, at a certain speed, the motor will operate at a power factor that is almost unity.

In some cases a variable ratio transformer supplies the excitation brushes so that the excitation flux can be reduced at starting, thus reducing the circulating currents in commutated rotor coils at starting and allowing more scope in the design of the motor. The transformer tappings can be adjusted to apply zero volts to the excitation brushes, the applied voltage being gradually raised to full value. Speed control can be obtained by the same means.

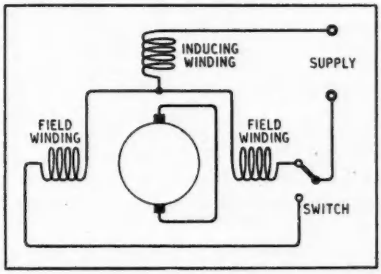


Fig. 2.—Electrically reversible repulsion motor

Another type of motor, termed the "series-repulsion" or "doubly-fed" motor, has the advantage of efficient operation at speeds above synchronous. As indicated in Fig. 4

this motor has a transformer field which can be regulated to give satisfactory commutation at various speeds. The rotor is supplied through a tapped transformer either independently of the stator windings or in conjunction with them. The brushes may be short-circuited at starting to enable the motor to start as a plain repulsion motor, the connections being changed automatically at synchronous speed. Above this speed the rotor-applied volts are increased and the stator volts reduced, so that the operating features then resemble those of a series motor which has also the advantages of a repulsion motor. The motor is, however, not suitable for use on such low voltages as the plain repulsion motor in which the rotor windings are entirely separate from the supply.

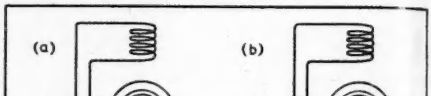


Fig. 4.—Alternative methods of connecting series-repulsion or doubly-fed motors

The repulsion-start-induction motor can be defined as a single-phase motor having a wound stator which is fed from the supply and a wound rotor which is similar to that of a d.c. armature and is connected to a commutator on which short-circuited brushes

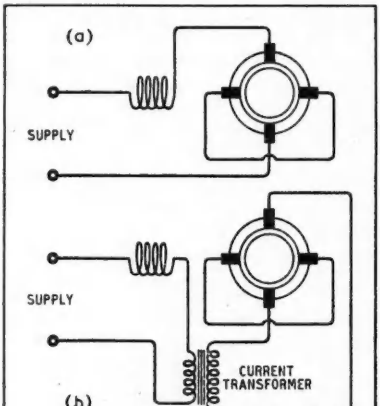


Fig. 3.—Two varieties of compensation-repulsion motor

operate, the rotor also being fitted with a centrifugal device to short-circuit the commutator at a pre-determined speed.

The motor starts as a plain repulsion motor with a high starting torque; when it has accelerated to the critical speed and the commutator has been short-circuited the motor continues to run with characteristics similar to those of a single-phase induction machine. The centrifugal device is often designed to raise the brushes from the commutator, after short-circuiting in order to minimize wear of both. The centrifugal device automatically removes the short-circuiter from the commutator and lowers the brushes when the motor has slowed down to a certain speed after switching off.

One short-circuiting device has a large number of copper segments which are restrained radially inside the end of the commutator by means of an encircling spring, centrifugal force on the segments causing them to fly outwards into contact with the commutator at the critical speed. Another kind has pivoted governor weights at one end of the rotor, and at the critical speed these move outwards to actuate a push rod through the rotor which slides short-circuiting contacts into position and raises the brushes by means of spring control. Fig. 5 shows a further pattern, in which a dead centre spring minimizes wear on the operating sleeve.

Its speed-torque characteristics make the repulsion-start-induction motor very suitable for driving machines having a heavy starting load which require a fairly constant speed on varying load, such as machine tools and compressors. The starting current is comparatively low and rotation can be reversed by resetting the brushes as in the plain repulsion motor. A special form of motor has two sets of field windings on the stator to create mutually perpendicular magnetic fields, reversal being obtained by altering the connections or by a two-way switch without brush shifting, but the motor must first be allowed to slow down to a critical speed.

The repulsion-induction motor has a squirrel-cage rotor winding made wholly or partly of copper, brass or even iron (depending on the characteristics required) in an inner set of slots, in addition to a d.c. winding and commutator. Its brushes are short-circuited as in the plain repulsion motor, but no additional short-circuiter is required as in the repulsion-start-induction motor. On no load the repulsion-induction motor usually runs above synchronous speed, and may get warmer than on full load. The change of speed from no-load to full-load is rather more gradual than in the repulsion-

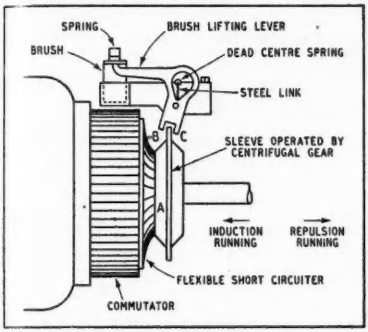


Fig. 5.—Brushgear and commutator on one type of repulsion-start-induction motor

start-induction motor, although the starting torque is generally somewhat lower.

This motor can be reversed by brush movement. It may also be fitted with a double-wound stator for reversing the current in one stator winding with respect to the other without brush shift. It can then be used for plugging into reverse and has this advantage over the repulsion-start-induction motor. It is a useful motor for driving a lathe, valve, rheostat, or similar apparatus requiring a higher starting torque than a squirrel-cage motor.

On some machines the stator is wound in two similar sections which can be connected in series for use on one voltage or in parallel for use on half voltage. This arrangement enables the stator windings to be tested by comparing the voltage drop across each section, if in series; or the current in the sections, if in parallel. Should the sections be connected in series and used on half voltage the motor will overheat on load, as the sections will then have to carry twice the intended current. If the sections are connected in parallel and used on the maximum voltage the magnetizing current will be excessive and overheating may occur on all loads. Open-circuiting of one section of parallel connected windings will result in overheating on load.

A short-circuited rotor coil will reduce the starting torque and may prevent starting. A simple test for such a fault is to raise all brushes from the commutator and switch the supply on to the stator windings in the usual way. Since, with a sound rotor, the total induced e.m.f. round the windings should then be zero, it should be possible to turn the rotor freely in either direction. If one coil is short-circuited the rotor will tend to set itself in the position in which that coil will embrace maximum magnetic flux; the faulty coil will then overheat and the stator current will increase slightly. One or two short-circuited rotor coils may possibly allow the rotor to accelerate. If a repulsion-start-induction motor can reach the critical speed at which the short-circuiter operates it may continue to run normally past this speed.

In the event of several rotor coils being short-circuited the motor may fail to start, the stator taking a fairly heavy current. If the rotor is totally short-circuited it will have no directional torque. Rotor short circuits may be due to the accumulation of foreign matter, such as dirt or carbon dust, on the intersegment of the commutator; or to carbonization of intersegment micas which may result from severe sparking at the

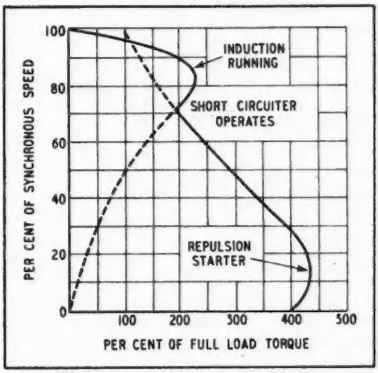


Fig. 6.—Relationship between speed and torque of repulsion-start-induction motor

brushes or short-circuiter of a repulsion-start-motor. Short circuits between commutator segments are generally indicated by sparking round the commutator at starting.

An open circuit caused by the melting of a soldered connection at the commutator will reduce the starting torque somewhat and will cause burning of the commutator segments connected to the faulty coil. A repulsion-start-induction motor may start satisfactorily with such a fault and may run normally after reaching the critical speed.

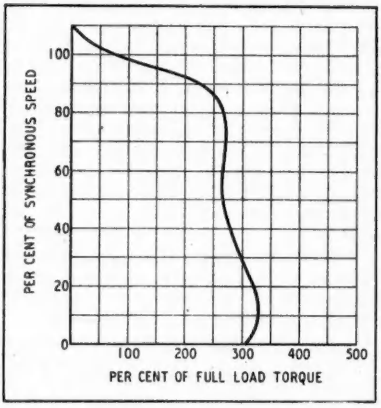


Fig. 7.—Speed-torque curve of repulsion-induction motor

As the brushes of a repulsion motor are often not insulated from the frame, an earth fault on the rotor or commutator will have a similar effect to a pulsating short circuit. To test for a fault of this nature, all the brushes except one may be raised from the commutator and the stator energized. An earth fault will cause the rotor to set itself in a certain position as in the case of a short circuit on the rotor.

Correct brush position is very important on a repulsion motor and should always be noted before dismantling. Usually the brush positions for both directions of rotation are clearly marked on the machine. Brushes of correct grade only should be used, as brush resistance is a critical factor in successful operation.

Many of such troubles as occur on repulsion-start-induction motors originate at the brushgear and centrifugal gear. Dirt or other foreign matter may allow the brushes to stick in their holders and prevent good contact with the commutator, particularly in a brush lifting motor. Faulty contact between brushes and commutator may also be due to the centrifugal gear sticking and thus failing to lower the brushes, incorrectly adjusted brushes, weak brush springs, worn or burnt commutator surface, projecting intersegment micas or badly worn brushes. Such faults may reduce the starting torque or prevent starting.

A repulsion-start-induction motor the brushes of which are not designed to be raised at critical speed, may owing to faulty contact between the short-circuiter and commutator, operate as a repulsion motor only at all speeds. In a brush-lifting motor with similar fault, the raising of the brushes at the critical speed will, however, cause open-circuiting at the commutator and fall of speed, so the motor will " hunt " round about the critical speed. Should the centrifugal gear stick with the short-circuiter in contact with the commutator, the motor will not be self-starting and a heavy current will flow on switching on.

Canadian Electrical Production

PARTICULARS of the production of electrical machinery and apparatus in Canada are now available in respect of 1944. The total value then was $283,071,000 compared with $245,771,000 in 1943, an increase of 15 per cent. The number of firms concerned was 234, eleven more than in the previous year; 167 of them were operating in Ontario.

In addition to these, however, there are some manufacturers of electrical supplies who are not included in the totals, those making, for example, porcelain insulators, and certain automobile accessories. The value of this additional output was about $17,000,000 in 1944. The principal items are shown in the accompanying table, with figures for 1943 added for comparison.

Class of Goods	1943 $000	1944 $000
Storage batteries and parts	7,479	9,024
Vacuum cleaners	246	264
Generators, a.c.	5,000	2,862
Generators, d.c.	2,345	3,049
Lamps, standard size	5,618	4,922
Lamps, miniature	1,221	1,049
Washing machines, electric	335	1,385
Furnaces	466	386
Watt-hour meters	639	1,338
Wires and cables	34,544	31,097
Motors, a.c. and d.c.	14,653	15,520
Radio apparatus and parts, other than valves and transformers	58,795	100,099
Radio valves	2,256	3,746
Refrigerators, electric	764	967
Transformers and parts	8,444	7,292
Telephone material	8,765	9,525
Stoves, grills, etc.	302	273
Switchgear and protective equipment (except telephone)	10,097	6,877
Wiring devices	4,215	4,513
Welding apparatus	2,082	1,215
Apparatus and parts, not elsewhere specified	43,397	42,907

Lead-Melting Furnace

A Development in Cable Sheathing

By G. Aldred,
B.Sc., A.M.I.Mech.E., A.M.I.E.E.

THE continued increase of the size of lead extrusion presses and the greater care exercised nowadays to improve the quality of the lead sheath applied to cables, allows the press crew very little time to attend to the equipment which furnishes the molten lead.

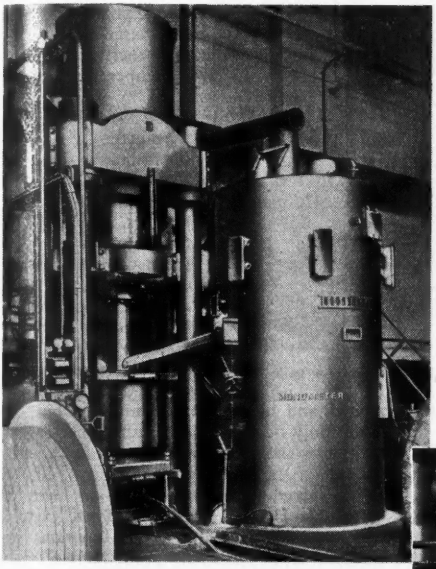


Fig. 1.—Cable-sheathing press (left) with lead-melting furnace alongside

With these facts in view the Monometer Manufacturing Co., Ltd., and Standard Telephones & Cables, Ltd., co-operated in the design of a furnace which is superior to the usual type in respect of simplicity in operation, maintenance and safety in unattended operation.

The press needs constant temperature lead in batches of 1,800 lb at intervals which may be as short as 14 minutes, or as long as one hour, depending on the size of the cable. Consequently the furnace has to be capable of melting at the rate of 7,000 lb per hour when loaded in batches of 1,800 lb at a time. For simplicity coal-gas firing without boosters was chosen, the melting pot being of heat-resisting cast-iron and having a capacity of about 7 tons. It is situated at such a height that the lead can flow by gravity into the press container (Fig. 1) approximately 6 ft 6 in. above floor level. The exhaust gases from the burners, after heating the pot, pass over the top of the pot so that the surface of the molten lead is exposed to an atmosphere of a less oxidizing nature than air.

Lead pigs weighing about 1 cwt are individually lifted on to a roller conveyor and pushed through a small self-closing trap door within the main drossing door (Fig. 2) to fall into the molten lead, so avoiding danger of the operator being splashed, while dross is removed by perforated ladles in the usual way. To protect the operator from the lead fumes and dust while removing the dross, the door is interconnected with two dampers and a fan controller so that when it is opened the fan is started, the main flues are shut, and flue gases extracted by exhaust together with air drawn in through the drossing door.

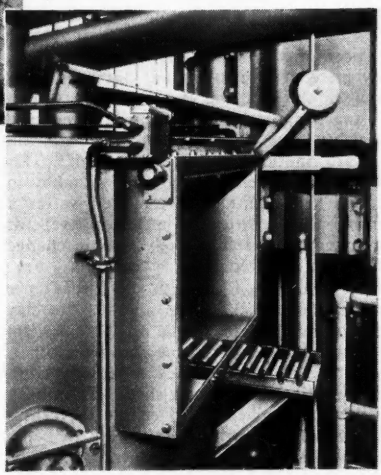


Fig. 2.—Furnace drossing door with roller conveyor for loading

The stirrer gear consists of the hollow frustum of a cone (Fig. 3) of 14 in. greatest diameter revolving at 120 r.p.m. and very strongly built; on test, it resisted all efforts to jam it by means of lead pigs. The upper bearing is carried well above the hot part of the furnace and is of the spherically located ball type of ample proportions. It is mounted in the gear box and constantly oil-lubricated, necessitating a packed gland, which has been remarkably trouble free. The lower bearing, which operates at a temperature of between 700 and 800 deg F, is a long cast-iron sleeve with three large vertical lobes kept constantly filled with graphite flakes loaded in the conical bearing housing. The consumption of graphite is very small and wear on the bearing is negligible.

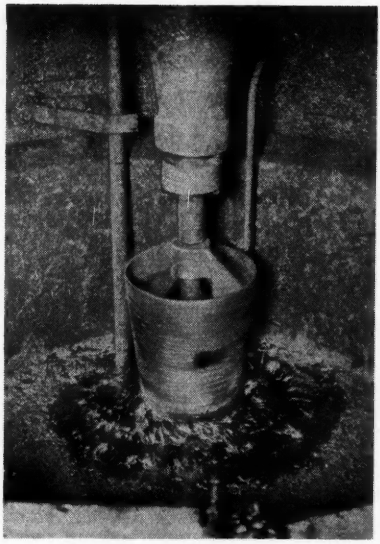


Fig. 3.—Hollow cone stirrer gear

Valves for drawing off molten lead from the pot are so designed that in any position, either open or shut, it is possible to rotate the valve itself without any danger of altering its position relative to the seat. Therefore, any piece of foreign matter that may lodge between the seat and the valve and stop it closing completely, can be quickly removed in safety by a simple rotary backward and forward motion of the valve itself. This feature has been particularly valuable in service. In addition to the feed valve, a drain valve is fitted at a lower level for emptying the pot completely when a change of alloy is required.

The furnace is lined with standard 41 per cent alumina bricks set in alumina fire clay and insulated. The bricks on the sides are arranged in three rings one above the other, each ring being supported separately from the ½-in. thick steel outer shell. The object of this arrangement is to enable the centre ring, which will wear most, owing to being subjected to the highest temperature, to be easily replaced from inside the combustion chamber without any danger of disturbing either the top or bottom rings. It should never be necessary to renew the bottom ring and rarely the top ring, which would necessitate the removal of the pot itself.

The combustion chamber itself is fitted with a large inspection door, so arranged that it can also serve as an explosion door. The burners are in a ring of twenty, firing directly on the pot with a fairly soft flame so as to reduce thermal stresses.

Temperature is regulated by means of an Electroflo 10-in. scale pyrometer controller operating a Drayton RQ-type gas valve for on/off supply to the burners. When the main burners are alight the gas consumption is of the order of 2,100 cu ft per hour, which is necessary to melt 1,800 lb of lead in the shortest time allowable. Once the lead is melted and up to temperature, the burners ignite only occasionally for short periods to maintain the temperature within a few degrees of the 730 deg F aimed at.

For safety, particularly when gas pressure is variable, Honeywell-Brown "Protectoglo" control was incorporated. It functions by conduction of electricity from an electrode through the flame to earth and stops the gas supply to the whole of the furnace almost instantaneously if the flame is extinguished, so preventing the combustion chamber being filled with an explosive mixture.

For lighting up, an ordinary match is applied to a pilot burner which consists of a ½-in. tube with a slot along its length and mounted so that one end of the slot is outside the furnace; it is open-ended at the other. The operator merely presses a button which energizes a small magnetic valve to admit gas to the pilot burner and applies a match to the part which is outside the main casing. The flame travels along the slot and impinges on the "Protectoglo" electrode which automatically "fires" the main burners.

Overseas Electrical Trade

Further Improvement in April

IN spite of the Easter holiday exports of electrical equipment from this country during April rose above the March total and, at £5,654,875, were 65 per cent above the April, 1946, figure and 209 per cent above the 1938 monthly average value. The rise above the corresponding month of last year was largely due to greater exports in the machinery class, although goods and apparatus also made a substantial advance.

It will be seen from Table I that while exports of telegraph and telephone cables (both land and submarine) were substantially lower the loss was more than compensated for by rises in the other cable classes. South Africa, British India and France made much smaller purchases of communications cable but the first two made up for this to some extent by larger orders for other types. Argentina bought more cable with insulation other than rubber.

There was another noteworthy increase in shipments of domestic radio apparatus but the greatest single advance occurred in the

Table I.—Electrical Exports and Imports

Class	Exports			Imports		
	April, 1947	April, 1946	Monthly Av., 1938	April, 1947	April, 1946	Monthly Av., 1938
	£	£	£	£	£	£
Telegraph and telephone wires and cables, submarine	3,787	38,993	17,289			
Ditto, not submarine	207,585	383,411	71,803			
Wires and cables, other than telegraph and telephone, rubber insulated	289,163	211,199	117,533	5,782	3,128	31,246
Ditto, insulation other than rubber	467,035	299,510	153,256			
Commercial radio apparatus	78,459	79,699	28,296	*	*	*
Domestic radio receivers	287,262	136,060	36,755	3,282	10,418	10,148
Telegraph, telephone and signalling apparatus	† 476,466	266,432	242,716	2,159	1,018	9,243
Other radio, etc., apparatus	154,709	90,871	57,848	83,924	78,854	47,870
Valves	96,380	70,161	41,272	16,575	1,134	10,893
Electric carbons, furnace	*	*	*	23,318	2,145	4,054
Other electric carbons	*	*	*	1,936	5,720	2,301
Electric lamps	89,837	91,490	49,440	8,195	24	10,265
Other lighting apparatus	210,658	138,525	48,565	2,877	1,245	38,662
Primary batteries	22,290	35,497	13,572	798	437	3,549
Accumulators, portable	116,197	95,051	28,874	*	*	*
Ditto, stationary	44,297	4,023	19,773	*	*	*
Ditto, parts and accessories	38,236	41,926	*	*	*	*
Electric cooking and heating apparatus	207,481	88,885	30,664	*	*	*
Commercial electrical instruments, including ammeters, voltmeters, etc., and parts	109,342	42,441	15,878			
House service meters	61,017	39,888	15,971	10,704	2,150	32,857
Other electrical instruments	26,202	32,864	9,612			
Electro-medical apparatus other than X-ray	17,749	9,174	3,038	*	*	*
X-ray apparatus, vacuum tubes and parts	92,830	82,777	4,881	6,978	9,095	9,734
Insulating materials, not elsewhere specified	89,723	109,881	19,343	*	*	*
Unclassified electrical goods and apparatus	177,536	182,275	108,083	16,014	5,611	52,980
Generators, complete, up to 200 kW	104,118	42,041	38,071	*	*	*
Ditto, over 200 kW	692,239	88,895	119,079	*	*	*
Ditto, parts	157,423	60,388	*	*	*	*
Railway and tramway motors	45,378	14,679	15,977			
Other motors up to ½ H.P.	30,392	15,372	9,001			
Ditto, over ½ H.P. but under 1 H.P.	28,770	8,888	2,470	3,059	6,163	26,033
Ditto, 1-250 H.P.	192,032	110,249	96,637			
Ditto, over 250 H.P.	24,276	10,191	20,960			
Converting machinery	17,204	816	101,304	*	*	*
Transformers including coils	340,866	166,305		*	*	*
Rectifiers for power-house use	25,491	14,753	3,463	*	*	*
Motor starting and controlling gear	83,779	49,562	50,866	*	*	*
Switchgear and switchboards, other than telegraph or telephone	367,179	150,428	184,533	*	*	*
Other electrical machinery	14,223	19,971	15,497	4,790	910	14,455
Electric vacuum cleaners and parts	166,711	55,134	26,662	*	*	*
Other electrically-operated portable appliances	10,553	29,760	10,553	4,759	2,717	24,627
Total	5,654,875	3,399,465	1,829,357	195,150	125,769	328,117

* Not classified separately. † The figures for 1947 are not completely comparable with those for previous years.

case of telegraph and telephone apparatus. British India headed the list of buyers of radio apparatus and there were very substantial increases in the shares of South Africa, Palestine, British Malaya, Iran and Brazil. South Africa was responsible for the largest purchase of telephone and telegraph apparatus but Spain was a very close second. Shipments to India and Australia showed large declines.

Table II.—Distribution of Exports of Electrical Goods and Apparatus

Destination	April, 1947	April, 1946	Monthly Av., 1938
	£	£	£
Eire	94,174	98,586	37,726
Channel Islands	26,308	31,799	12,177
Palestine	81,233	43,544	8,426
British West Africa	17,526	15,872	12,889
Union of South Africa	403,542	240,476	162,584
Southern Rhodesia	29,288	18,376	9,632
British East Africa	33,730	18,358	7,893
British India	457,227	384,338	123,789
Burma	47,425	474	5,337
British Malaya	109,668	31,755	32,792
Ceylon	29,198	12,104	15,048
Hong Kong	36,359	10,008	12,939
Australia	137,067	173,049	197,366
New Zealand	154,393	105,223	96,225
Canada	12,255	12,406	12,547
British West Indies	21,082	13,409	12,954
Other British Countries	62,675	40,147	21,265
Soviet Union	154,152	74,046	36,781
Finland	24,074	10,396	5,969
Sweden	50,582	24,977	14,948
Norway	152,924	45,757	12,881
Iceland	22,670	18,727	2,796
Denmark	49,693	56,186	18,907
Poland	30,659	6,100	9,702
Netherlands	62,616	88,943	22,010
Belgium	113,333	123,525	11,208
France	38,119	131,934	16,082
Switzerland	33,615	13,385	3,768
Portugal	53,628	76,575	6,512
Spain	62,051	25,387	3,813
Czechoslovakia	22,532	52,670	7,256
Yugoslavia	42,048	21,181	1,475
Greece	4,773	4,955	4,926
Turkey	31,045	55,245	7,684
Portguese East Africa	19,742	6,310	6,942
Egypt	26,905	66,198	13,176
Iraq	39,107	34,997	5,530
Iran	67,981	83,510	16,345
China	51,374	88,006	4,119
United States of America	12,635	6,513	5,839
Mexico	10,550	7,362	1,466
Venezuela	15,525	9,055	2,936
Chile	24,462	12,687	6,635
Brazil	64,382	11,860	11,164
Argentine Republic	156,124	88,429	45,452
Other Foreign Countries	163,790	76,193	46,371
Total	3,354,241	2,571,033	1,134,284

The increase in the total value of exports of electric lighting equipment was accounted for by rises in respect of British India, South Africa and other British countries; foreign countries took a smaller proportion. About a third of the accumulators went to South Africa and British India. No details are given of the distribution of electric cooking and heating apparatus which went up from £88,815 in April, 1946, to £207,481 last month; the 1938 monthly average was only £30,664.

Taking electrical goods and apparatus as a whole, Table II shows that the leading customer was British India (£457,227) followed by South Africa (£403,542), Argentina (£156,124), New Zealand (£154,393), Russia (£154,152), Norway (£152,924) and Australia (£137,067). The shares of Norway, Russia and Argentina showed noteworthy advances. There was a large decline in France's imports—from £131,934 to £38,119.

While goods and apparatus exports advanced by about 30 per cent as compared with April last year, exports in the machinery class (including switch and control gear, rectifiers, transformers, etc.) were about 175 per cent higher. The leading item in the machinery list was generators of over 200-kW capacity which, at £692,239, represented a rise of 679 per cent as compared with April, 1946. It is apparent from an analysis given in the Board of Trade returns that Russia was responsible for the bulk of this rise; that country's imports of British generating plant as a whole went up from £38,727 to £521,525. British India's share also showed a substantial increase—from £53,523 to £184,239. Exports of motors were double the April, 1946, value; this was mainly attributable to unspecified foreign countries whose imports rose from £40,926 to £144,674.

The Soviet Union was also a large customer for all other classes in the machinery section with a total of £315,672, against £16,868 in April last year. In this direction South Africa was the second largest purchaser, taking goods valued at £168,809 (against £37,891); India's purchases dropped from £137,800 to £79,620.

In the first four months of this year electrical exports reached a total of £21,320,350 as compared with £13,560,225 in the corresponding period of last year, and with £7,316,800 as a third of the 1938 total.

Import Trade

Electrical imports were higher than in April, 1946, but were still well below the 1938 monthly average. Something over half of the total was made up of radio apparatus and valves, but the value of imported carbons of all types was greater both as compared with April last year and the 1938 average. Most of the imports of electrical goods and apparatus came from Canada (£63,665) and the United States (£71,184).

COMMERCE and INDUSTRY

Electrical Equipment Production. Essentials in Export Trade.

FROM information published in the April *Monthly Digest of Statistics* it is seen that in January last hydraulic turbines totalling 42,000 B.H.P. were delivered; there remained on hand orders to the extent of 1,299,600 B.H.P. Deliveries of steam turbo-alternators of 10,000 kW or over amounted to 60,000 kW, with a further 5,748,400 kW in hand.

Figures showing the production of electrical appliances during 1946 indicate that 2,598,000 electric fires were made, including 2,280,000 for the civilian home market. A total of 3,294,000 electric irons included 2,557,800 for the home market. Out of 637,200 vacuum cleaners produced 502,800 were for home consumers and the total of 614,700 kettles included 489,900 for the home market.

Valve Manufacturers' Convention

Mr. J. M. Storey, managing director of Dewrance & Co., Ltd., in his presidential address at the summer convention of the British Valve Manufacturers' Association at Harrogate on May 14th, described the conditions which he found during his recent visit to the United States, Spain and Portugal. He expected to find production methods in America much in advance of those employed here, but this was the exception, although special purpose machinery was in greater evidence than in this country. In the Iberian Peninsula Mr. Storey found a tremendous potential capacity for industrialization the development of which was at present being handicapped through shortages of dollars and sterling. Mr. Bruce Ball, of Glenfield & Kennedy, Ltd., who had recently returned from South Africa, stressed the growing demand in that country for the exclusion of price variation clauses attached to tenders.

The Export Drive

At a luncheon held by the Advertising Association last week during its conference the speaker on the subject of "The Export Drive" was Sir Claude Gibb, chairman and managing director of C. A. Parsons & Co., Ltd. He said that we were spending too much, talking too much and planning too much. There was room for only one party to-day—a "Save Britain" Party to put Britain back on the map. He cautioned politicians generally that things said and taken at their true value in the give and take of debate, often seemed to have a far greater importance outside the House, and a slanging match in Parliament could colour the whole outlook on works management. Speeches of some kinds made it more difficult than ever to get co-operation in industry.

Speaking of the heavy electrical industry, Sir Claude said that any attempt to divert equipment already designed for overseas to meet the immediate needs of this country would have the effect of losing us those overseas customers for many years to come. Deliveries were so difficult already that interference with them would destroy the confidence and goodwill of buyers abroad. With the Dominions and other countries having developed industries to supply their own war needs and converting those industries to peacetime production, he forecast that in ten years' time Britain's only exports would be goods of superlative quality and goods of a type not economical to produce in particular countries abroad. He urged his audience to preach the gospel of handiwork. Britain had the skill necessary to retain its position as an exporter, but it must reduce costs of production, and get a bigger amount of work per man-hour from everyone. Competition was essential to maintain efficiency.

Welding Research

Two documents recently issued by the British Welding Research Association deal respectively with the relationship between welding conditions and the strength and quality of single spot welds in deep drawing quality mild steel sheet of 20 to 14 s.w.g. thickness (report FR. 1/9) and arc welded structural steelwork, stanchion bases, caps and joints (memorandum T. 17). Both will be published in association with the transactions of the Institute of Welding for April in the first issue of "Welding Research," the new official organ of the Association.

Salford Vacancy

It is reported that the Salford Light, Heat and Power Committee is not proceeding with the appointment of a city electrical engineer until the salary dispute is settled. Originally the post was advertised at a salary of £1,400 a year, rising to £1,650 in two years, but the Standing Committee of the A.M.E.E. and E.P.E.A. contended that under the "Walker" Agreement it should be £1.833 rising to £2,156 in the third year.

Plural Starting

Some industrial processes involve the continuous running of electric motors, so that their starters often remain idle for days, or even weeks, for example in ships' engine-rooms, paper mills and chemical factories. The individual starters occupy valuable space and often are of substantial size and cost. In contrast the G.E.C. "plural starter" system enables a single starter to perform the duties which otherwise will necessitate a separate starter for each of a large number of motors. Over forty such installations have already

been made in ships and others are now in course of construction. The 10,000-ton M.V. *Somerset* of the Federal Steam Navigation Line is an example of a single plural starter serving 11 motors varying from 8 to 40 H.P., and in a new passenger vessel now under construction there are two equipments for a total of 24 motors ranging from 15 to 155 H.P. Recent improvements have simplified the system and extended the range of motor sizes which can be controlled in this way from 100 to 350 H.P. for industrial installations. Although the system is primarily designed for starting d.c. motors it can in many cases be employed with a.c. motors, other than those arranged for star-delta starting.

Appliance Factory in Wiltshire

C. H. Blackburn & Co., Ltd., have opened a new factory at Calne in Wiltshire, for the manufacture of a comprehensive range of domestic electrical appliances, in addition to their immersion heaters and hospital equipment. The new factory, which was constructed entirely by local labour on the site of a derelict saw mill, was recently formally opened by Councillor Thomas, the Mayor of Calne. The chief engineer is Mr. B. C. Elliott, and the works manager, Mr. A. P. F. Rogers, A.M.I.E.E.

Works Visit

Seven Finnish newspaper editors saw automatic telephone equipment being manufactured at the Strowger Works of the Automatic Telephone & Electric Co., Ltd., on May 15th. The visit was arranged by the Central Office of Information and the party was accompanied by Mr. D. R. Roper, information officer, British Legation, Helsinki. Mr. J. Mason, manager, told the visitors that 60 per cent of the factory's output was to fill export orders and that at the present time shortages of raw materials, notably rolled brass and sheet nickel-silver, were presenting difficulties.

E.M.I. Workers Filmed

Shooting of the first of a new series of films being made for the Board of Trade to stimulate the export drive has just been completed in the Hayes factories of Electric & Musical Industries, Ltd. Although the film is primarily concerned with the factory and its methods, a complete departure has been made from the more orthodox "documentary" by the introduction of a "human interest" story in which E.M.I. employees provide the cast.

Equipment for French Dredgers

The French Government has ordered electrical equipment from Britain for four large dredgers to be used in cutting a new canal between Donjere and Mondragon, near Avignon, in the south of France. Each of the dredgers is completely electrified, with all drives provided by electric motors, totalling 1,050 H.P. per dredger. The supply is taken from nearby h.v. land lines on to the dredgers, where it is transformed down to 380 V, three-phase. The biggest individual drive is that for the bucket chain, which requires 350 H.P. Several other motors of over 100 H.P. are required for driving hoists or conveyors. For manœuvring, Ward-Leonard controlled winches are employed. Seventeen main motors on each dredger equipment are controlled by means of automatic starters, arranged to work in sequence to ensure correct starting and control of the complete equipment. The comprehensive control equipment is being specially designed and constructed by Brookhirst Switchgear, Ltd.

Australian Overseas Trade

The Australian Bureau of Statistics has issued preliminary figures of the overseas trade of the Commonwealth for the six months ended December last. Imports of electrical appliances and equipment were valued as follows, with comparative figures for 1945:—

Class	1945 £000	1946 £000
Batteries and accumulators	54	96
Cable and wire, covered	185	283
Dynamo-electric machines	646	385
Lamps, filament	75	77
Telegraph and telephone instruments, etc.	506	507
Other electrical machinery and appliances	1,426	858

Exports of electrical appliances and equipment were valued at £A416,000 in July–December, 1946, against £A170,000 in July–December, 1945.

International Chemical Congress

The programme of the Eleventh International Congress of Pure and Applied Chemistry (at which twenty-four countries are to be represented), which is to be held in London from July 17th to 24th, can now be obtained from the Joint Press Officers, 11, Garrick Street, London, W.C.2. The sessions will be divided among fourteen sections and a social programme has been arranged. The opening ceremony by the president, Lord Leverhulme, and the closing session, consisting of a lecture by Sir Robert Robinson, will be at the Central Hall, Westminster; other sessions will be held at the Imperial College of Science and Technology, South Kensington.

The "Trader" Handbook

In the forty-first edition of the "Trader" Handbook, just published, all the regular features have been retained and many new ones added. The legal guide has been much enlarged and now covers points of the law governing normal trading conditions. The principal trade and professional organizations are given in alphabetical order. Motor vehicles servicing data, providing tables of measurements, now covers 1939–1946 models. The garage equipment section has been reintroduced in classified

form under more than two hundred headings. Other new features include British tractor specifications, technical data such as international standard screw threads, metric and decimal equivalents, etc. The Handbook is published by The Trader Publishing Co., Ltd., Dorset House, Stamford Street, S.E.1, at 12s. 6d., post free (Overseas, 14s. 6d.).

Philips Factory Extension

Mr. Joseph Westwood, Secretary of State for Scotland, laid the foundation stone of a new £600,000 extension to the Philips radio factory at Hamilton, Lanarkshire, last Friday. He said that the firm would be the first in Scotland to manufacture complete radio sets and would be one of the first post-war projects to get into full production. About 1,000 people are employed at the existing factory, and when the new extension is in production the workpeople will number about 2,500.

Lighting in Industry

To enable those concerned with industrial management, administration and welfare to assess the merits of their own lighting installations and of lighting schemes under consideration the Lighting Service Bureau (2, Savoy Hill, W.C.2) has prepared a memorandum on lighting in industry based on a report submitted by the Bureau to the various Working Parties set up by the President of the Board of Trade. After dealing with legislation, the memorandum briefly sets out the principles of good lighting and reviews present lighting standards and practice. Technical terms, lamps and lighting costs, and colour in industry are also touched upon. Only a very limited number of the booklets is available and applicants should indicate their reason for wanting copies.

Glasgow Illumination Design Course

The first Illumination Design Course to be held in Glasgow since the war opens at the Lighting Service Bureau, 29, St. Vincent Place, C.1, on June 3rd and will last three days. Subjects to be covered include "Lighting Terms and Definitions," "Seeing," "Interior Lighting Design," "Modern Lighting Practice," "The Economics of Artificial Lighting," "Light in Industry" and "Lighting for Effect."

Remuneration for Southwick Extensions

Brighton Town Council was recommended at its meeting yesterday to pay the borough electrical engineer and manager, Mr. H. Pryce-Jones, £2,000 a year additional remuneration in respect of his added responsibilities as chief engineer and mechanical and electrical engineering consultant for the construction of the new Southwick power station. The Electricity Committee also recommended that Mr. T. Yule, deputy engineer and manager, should be paid an extra £500 a year for five years, and that £1,000 a year for five years be allocated for distribution among members of the Corporation staff engaged in the work. These extras would rank as part of the capital cost of construction.

Electrical Components Acquisition

The directors of Electrical Components, Ltd., announce that they have acquired the whole of the share capital of Flinders (Wholesale), Ltd., of Ipswich, Colchester, Norwich and Cambridge. This is in pursuance of the company's policy to establish a national distributing organization, and brings the total number of branches in the group to twenty-two. Flinders (Wholesale), Ltd., will continue as an independent trading unit, Mr. C. C. Scott remaining as managing director.

Technical Teachers' Conference

The annual conference of the Association of Teachers in Technical Institutions was held in London from May 23rd to 26th, when Mr. W. Ing delivered his presidential address.

London Electrical Engineers

The London Electrical Engineers, which is one of the oldest Territorial formations and which operated as Searchlight Regiments during the last war, is now being re-formed. During the war when searchlights were transferred from the Royal Engineers to the Royal Artillery they also became R.A. Now that the Territorial Army is being reconstituted the L.E.E. are again to become Royal Engineers as 323 and 324 Electrical and Mechanical Squadrons R.E. Details of these units can be obtained from the Adjutant (Capt. H. J. Colter, R.E.), 121 Construction Regiment, Duke of York's Barracks, Chelsea.

Presentation of Technical Information

Professor R. O. Kapp is to repeat his course of lectures on "The Presentation of Technical Information" on June 2nd, 9th, 16th and 23rd at the Institution of Electrical Engineers, Savoy Place, W.C.2.

B.S. for Magnesium Alloys

Magnesium alloys in the following wrought forms are covered by a new British Standard, 1350-57: 1947:—Forgings, press forgings and stampings; sheet and strip; bars and sections; tubes. Chemical composition, mechanical properties and test requirements are given. This specification follows B.S. 1272-1280: 1945 for magnesium alloy in the form of ingots and castings. The publication of a further specification for a series of alloys based on high purity magnesium is contemplated.

British Display in Copenhagen

Arrangements have been made, with the approval of the British and Danish Governments, to hold an All-British Exhibition in Copenhagen in September next year. It will

be organized by the British Import Union of Copenhagen in collaboration with the Federation of British Industries, as was done in the case of the successful British Exhibition in Copenhagen in 1932. As soon as the necessary plans and other information for intending exhibitors are completed, a further announcement will be made.

E.W.F. Aid for E.I.B.A.

With reference to the note in our last issue relating to contributions by members of the Electrical Wholesalers' Federation to the Electrical Industries Benevolent Association, the Association informs us that these contributions amounted to £1,358 and not £1,280 as stated.

Trade Announcements

The address of the Brighton office of British Insulated Callender's Cables, Ltd., is now 59a, Middle Street, Brighton (telephone: Brighton 9212).

The Edinburgh office and stores of Berry's Electric, Ltd., has moved to 19, Forth Street, Edinburgh, 1 (telephone: Edinburgh 32734).

The Supply Department of the Donovan Electrical Co., Ltd., has moved from Flaxley Road, Stechford, Birmingham, 9, to 70/82, Granville Street, Birmingham, 1, which will in future be the address of the head office and warehouse. The works remain at Northcote Road, Stechford, Birmingham, 9.

Dissolution of Partnership

Messrs. E. B. Barrow and D. P. Tudor, carrying on business as electrical contractors at 1a, Scarisbrick Avenue, Litherland, Lancs, under the style of B. & T. Electrical Service, have dissolved partnership. All debts due and owing to the firm will be received and paid respectively by Mr. E. B. Barrow who will continue to carry on the business under the same title.

British Industries Fair

In addition to the exhibitors at the British Industries Fair, Birmingham, mentioned in our issue of May 2nd, Richard Thomas & Baldwins, Ltd., exhibited a varied selection of electrical stampings and laminations of all types, including built-up cores and also an illuminated cabinet demonstrating the assembly of varnished segments into large cores for turbo-alternators.

Electric Railway Calculations

A machine that is claimed to reduce substantially the work of calculating the power taken and the number and siting of substations required for a railway electrification scheme and of getting out the corresponding time-tables has been designed by Mr. P. Angus of the New Zealand Railways Department. Its construction cost £600 and took five months—only one month longer than was required by the inventor originally to compute mathematically the requirements for the projected Hutt Valley electrified railway system. The same task was done by the machine, operated by two men, in sixteen hours. The dimensions of the apparatus are 7 ft long by 6 ft high and its weight is 7 cwt.

Trade Publications

English Electric Co., Ltd., Queen's House, Kingsway, London, W.C.2. — Illustrated brochure (SG/111) on self-contained two and three stage air compressors.

Birmingham Aluminium Castings (1903) Co., Ltd., Dartmouth Road, Smethwick, 40, Staffs.—Illustrated data booklet and guide to the selection of " Birmal " aluminium, magnesium and zinc casting alloys.

T.M.C.-Harwell (Sales), Ltd., 37, Upper Berkeley Street, London, W.1.—Illustrated catalogue with price list of extended range of " Temco " synchronous mains driven clocks.

Cinema-Television, Ltd., Worsley Bridge Road, Lower Sydenham, London, S.E.26.—Leaflets describing " Cintel " recording instruments, counter and microsecond chronometers, electronic and process timers, electronic metal detector and photo-electric cells.

A. Gallenkamp & Co., Ltd., 17-29, Sun Street, London, E.C.2.—Catalogue No. 508 containing illustrated particulars of " Gallenkamp " specialities, including thermostat baths, electric and hand centrifuges, electrically heated furnaces, drying ovens and hot-plates, and ultra-violet lamps.

McKechnie Brothers, Ltd., Rotton Park Street, Birmingham, 18.—A well-produced and illustrated catalogue of extruded rods and sections in brass, bronze, nickel, silver and copper, giving technical details of mechanical properties and chemical compositions. A feature of the catalogue is its extruded metal binding.

Mercury Discharge Lighting Co., Ltd., 96a, Holloway Road, London, N.7.—A folder illustrating fluorescent lighting units by actual photographs.

The Northern Aluminium Co., Ltd., Banbury, Oxon.—A well-produced and illustrated brochure describing mechanical tests and their bearing on working properties.

Birlec, Ltd., Tyburn Road, Erdington, Birmingham, 24.—Publication No. 64 dealing with Birlec-Tama induction melting furnaces for aluminium and light alloys.

Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1.—A brochure, illustrated in colour, describing some of the many applications of plastics in industry.

Oldham & Son, Ltd., Denton, Manchester.—An illustrated catalogue of " Power " batteries for passenger transport vehicles, a booklet describing the operation and maintenance of miner's cap lamp type " G," and a catalogue of " Heavy Duty " and " Power " batteries for commercial vehicles.

Protolite, Ltd., Central House, Upper Woburn Place, London, W.C.1.—Illustrated brochure describing milling cutters.

Welding in Power Stations

Many Actual and Potential Applications

By M. P. Henzell, A.M.Inst.W.

PROGRESS in the construction of all-welded bridges warrants belief that similar methods may find application to the steel frames of power-station buildings in the not too distant future. Cylinders and rotors of modern land turbines are now almost without exception casting and forgings. Wartime urgency, however, resulted in the production of all-welded low-pressure turbine cylinders for warships[1]. Combined welding and casting has been used for land turbine low-pressure cylinder nosings, and it therefore appears likely that low-pressure turbines will be fabricated in the light of experience gained in naval construction.

Welded turbine rotors have been constructed from time to time for many years[2], but their general use has been somewhat limited because of the great importance of this part and the severe operating conditions. The stresses induced in a turbine rotor can be materially reduced by welding in place of forging and for this reason greater use will probably be made of the former.

Welding at present plays its greatest part in the construction of turbine auxiliaries, the most important being the exhaust-steam condenser, the shell of which is always a fabricated part and may weigh up to 40 tons. Bled-steam heaters, drain coolers and oil coolers have their bodies rolled from sheets followed by seam welding to form the outer casing to which the flange plates are welded.

The bellows in the expansion piece of turbine cylinder interconnector pipes is formed in two halves which are then welded together around the periphery. Oil-pipe flanges are welded on and all low-pressure pipes are fabricated. Wire netting is tack-welded to cylinder casings to enable the casing lagging to adhere more closely. High-pressure pipe joints are usually welded and probably the most widely used type is the Dawson joint shown in Fig. 1.

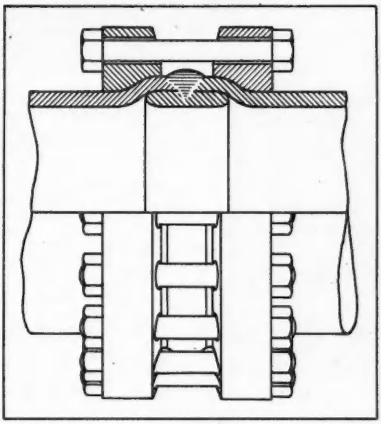


Fig. 1.—Arrangement of Dawson high-pressure pipe joint

Alternator stators are always weldings and have been for many years. They first came into use when the demand for larger alternators outstripped the capacity of ironworks cupolas to produce big enough castings. The change to welding resulted in a very great saving in time of manufacture, cost and weight, whilst the finished stator is much stronger than a casting. The air ducts through which the hot air is drawn from the stator are shaped from mild-steel plates and seam-welded. Where a separate air-cooling fan is fitted, the casing may be built up and welded from plates with stiffening angles welded to the external surface. Exciters are mounted on welded bedplates and the yoke of smaller machines may be a welding formed by rolling heavy plate into a cylinder and butt-welding the joint, after which the feet and lifting eyes are welded on.

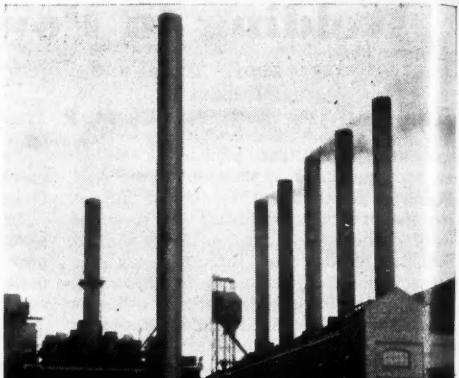
Many modern boilers are fitted with fusion-welded drums in place of riveted or solid-forged drums. The use of a welded drum ensures a more scientific design than a solid forging, because the drum thickness round need not be as great as the tube plate. Increasing use of steam pressures and temperatures in excess of 1,000 lb. per sq. in., and 900 deg F has resulted in a considerable amount of trouble in effecting steam-tight tube expansions[3, 4]. This has been overcome by welding stub tubes into the drum and then butt welding the boiler tube to the stub tube or by welding the boiler tube directly to the drum. Superheater tubes in particular are now almost always butt

welded to stub tubes welded into or extruded from the superheater header.

Boiler air, gas and coal ductings, fan, air heater, economizer and boiler casings and hoppers are fabricated from plates cut to shape by oxy-acetylene cutting. Where boiler chimneys are of steel the tendency is to replace riveted construction by weldings. The tallest steel power station chimney in the country is of welded construction; it is 300 ft high and weighs 150 tons[5]. The list could be extended to include switchgear, transformers, etc.

Welding plays an important part in maintenance, and most stations employ at least two or three welders under the supervision of a maintenance engineer with a knowledge of welding procedure and metallurgy.

The complex alloy steels which are used for high-pressure and temperature turbine cylinders and steam chests have not always proved satisfactory in service because of cracking. Such cracks may be internal, in which case they can be located only with crack detectors of the supersonic type[6]. Cracking can often be repaired by cutting out the crack by gouging with an oxy-acetylene gouger or by drilling and then building up with weld metal.



Sculcoates power station, Kingston-upon-Hull, showing tallest steel chimney in Great Britain

Faulty boiler tubes can be quickly removed by cutting with an oxy-acetylene torch in preparation for the fitting of new tubes. A skilled operator can cut a tube out of the expansion without damage to the tube hole in the drum. Air-heater elements of the plate type can be quickly fabricated to replace those worn by erosion or corrosion. Coal, ash, gas and air ductings can be patched at points of maximum wear by cutting out with gas and welding new plates into position.

Of particular importance at present, when long delivery times may hold up repairs, is the use of welding to build up worn parts such as shafts and gears by depositing weld metal and then machining or cutting to size.

In the past generating engineers have not always looked upon a welded article with favour, and the writer suggests that bad workmanship and inexperience are the reasons for this disfavour. Important work must be carried out only by highly skilled operators under the direction of qualified welding engineers.

References: [1] "Some Aspects of Production," by J. R. Ferguson. Larke Medal Papers, Institute of Welding, 1946. [2] Brown-Boveri Review, January, 1931. [3] Expanded Tube Joints in Boiler Drums, *Journal* I.Mech.E., June, 1946. [4] Investigation of Steam Generating Plants and Boiler Practice in Central Germany. B.I.O.S. Final Report No. 336, Item Nos. 31, 33. [5] *Electrical Review*, December 13th, 1946. [6] "Metal Progress," September, 1945.

Precision Engineering

AT Bishop's Cleeve, Cheltenham, a technical school has been established by S. Smith & Sons (England), Ltd., at which theoretical and practical training is given in the various aspects of precision engineering. Candidates between the ages of fifteen and seventeen are selected by examination and interview and serve a probationary period of six months; they are remunerated and pay no fees. Accommodation can be found for them near the school if required. The school is very well equipped, with machine, metrological and heat treatment laboratories, tool stores, drawing office, etc. The aim of the school is to produce designers, instrument and clock engineers, production and methods engineers, estimators, inspectors, specialists, toolmakers, etc. The company has sent us a copy of a handsomely produced brochure, with many illustrations, giving full particulars.

ELECTRICITY SUPPLY

Shoreditch Jubilee. Pinkston Station Reconstruction.

Clitheroe.—STANDBY TRANSFORMER.—The views of the Electricity Commissioners are to be obtained by the Electricity Committee concerning the advisability of installing a 10,000-kVA transformer for standby purposes.

Fulham.—CONSENT TO EXTENSION.—Formal consent has been received from the Electricity Commissioners to the further extension of the power station, making the total capacity 360,000 kW.

DISTRIBUTION REORGANIZATION.—As part of the reorganization of the distribution system, it is proposed to purchase from the L.M.S. Railway Co. a site for a substation in Beaumont Avenue (West Kensington area).

ELECTRICITY BILL.—The Electricity and Lighting Committee recommends that the local M.P's shall be asked to take all possible steps to secure an amendment of the Electricity Bill to provide for a scheme of administration below Area Board level on the lines suggested by the I.M.E.A.

Hackney.—BULK SUPPLY TO STOKE NEWINGTON.—The Electricity Committee has received sanction to a loan of £15,850 for mains and transformers in connection with the provision of a bulk supply to Stoke Newington.

Hammersmith.—FACTORY SUPPLIES.—Mains extensions to supply George Wimpey & Co., Ltd., Hammersmith Grove, and F. A. Clark & Son, Ltd., Phœnix Lead Mills, will cost £2,700 and £2,250 respectively.

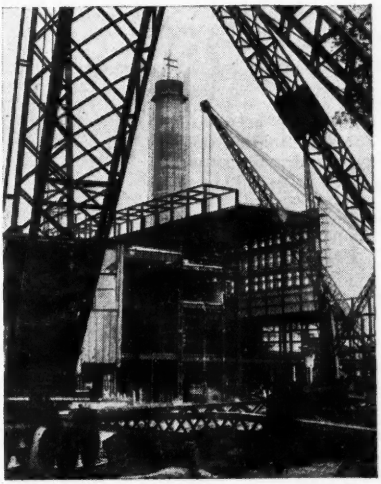
Kingsbury.—EXTENSION OF TIME.—The Electricity Commissioners have made an order extending to June 30th, 1950, the period at the expiration of which the Wembley Council may purchase the Kingsbury undertaking from the Northmet Power Co.

Lerwick.—UNDERTAKING TRANSFERRED.—The North of Scotland Hydro-Electric Board has taken over the electricity undertaking of Lerwick, capital of the Shetland Islands, which was inaugurated sixteen years ago and has cost £60,000. The ceremony took place on May 13th.

Letchworth. — TRANSFER APPLICATION. — Notice is given in the *London Gazette* that First Garden City, Ltd., has applied to the Electricity Commissioners for a Special Order authorizing the transfer of the undertakings covered by the Letchworth and District Electricity Orders 1924 and 1925 to Letchworth Electricity, Ltd.

Manchester.—ECONOMY APPEAL. — The Manchester and Salford District Committee of the North-West Regional Board for Industry has expressed concern at the tendency of the electricity load to revert to the initial position, particularly among the smaller industrial users. The Committee appeals to consumers to exercise the utmost economy, especially at the peak period, and expresses disappointment that more progress has not been made in shifting the peak load.

Oldham.—INTERCONNECTION SCHEME.—The Electricity Committee is seeking sanction to a loan of £44,630 for a scheme to provide additional interconnecting capacity between the Chadderton and Greenhill power stations. The scheme involves the substitution of the existing 8,000-kVA transformer at Chadderton by one of 20,000 kVA, the removal of the displaced transformer to a substation at Greenhill, the provision of the necessary switchgear, erection of substation building, cable connections and fire protection.



View of the new power station which is in course of construction at Kingston-on-Thames

Otley.—EXPERIMENTAL STREET LIGHTING.—Electrical Distribution of Yorkshire, Ltd., has been given permission by Otley Council to install in Kirkgate, Otley, experimental street lighting by means of fluorescent tubes fixed to the walls of buildings. The Council has promised the electricity company all reasonable assistance in this experiment.

St. Pancras.—HIGH-VOLTAGE SUPPLY. — The British Non-Ferrous Metals Research Association having applied for a h.v. supply in connection with certain developments contemplated at Regnart Buildings, the Electricity and Public

Lighting Committee is varying a previous scheme to provide for the installation of sub-station equipment at those premises.

I.M.E.A. RESOLUTION NOT SUPPORTED.—The Committee does not support the amendment of the Electricity Bill proposed by the I.M.E.A., providing for a scheme of administration below Area Board level.

Scarborough. — LOAN APPLICATION. — The Corporation is to make application to the Electricity Commissioners for sanction to the borrowing of £30,000 made up as follows:— Mains and services, £15,000; substations and equipment, £10,000; meters, £4,000; consumers' apparatus, £1,000.

Shoreditch. — ELECTRICITY UNDERTAKING'S JUBILEE.—Celebrations of the Jubilee of the electricity undertaking (which was inaugurated on June 28th, 1897), will include a civic dinner, a social evening for the employees of the Electricity Department and their wives, and an exhibition dealing with the undertaking's activities during the past fifty years.

Stockton-on-Tees. — FLUORESCENT STREET LIGHTING.—On the recommendation of the general manager the Corporation is to have a trial installation of fluorescent street lighting, consisting of six suspension fittings in the Bishopton Lane—Norton Road area. The fittings are being supplied by the British Thomson-Houston Co., and will be erected by the Electricity Department.

NEW SUBSTATION.—A new substation is to be installed in Oxbridge Lane at an estimated cost, including switchgear and associated equipment, of £5,900.

NORTH TEES TRADING ESTATE.—Electricity is to be made available to the North Tees Trading Estate and an initial supply of approximately 1,500 kVA will be provided towards the end of 1947. The preliminary scheme will involve a "loop" from the existing 11 kV system, and the estimated cost of the substation and associated equipment is £7,410. When the estate develops, a demand of approximately 12,000 kVA is anticipated and this will necessitate a connection from the 66-kV grid supply through the North-Eastern Electric Supply Co., Ltd.

RADIO AND TELEVISION.—The Electricity Committee considered a report by the Town Clerk on the general manager's suggestion that the Corporation should provide facilities for the sale and servicing of radio and television receivers, and the principle was accepted by the Committee. The engineer has been instructed to prepare a full detailed scheme.

Walsall.—ADDITIONAL SWITCHGEAR. — A scheme for the provision of additional switchgear in connection with work to be carried out by the West Midlands J.E.A. and estimated to cost £24,280 has been authorized.

Warmley.—DISTRIBUTION WORKS.—Expenditure by the Electricity Committee of the R.D.C. during the next three years is estimated to amount to £25,560, including the cost of proposed extensions to Kelston and North Stoke. A scheme submitted by the electrical engineer (Mr. W. Bowler) for improving the supply in the Syston Court and Beech areas was approved at the last meeting of the Council.

Overseas

Canada.—FREQUENCY-CHANGE PROPOSAL.—Proposals are under discussion for the conversion of the Southern Ontario 25-cycle system to 60 cycles at a cost of about $200 million. It is stated by the Hydro-Electric Commission of Ontario that the change-over would be achieved without any cost to domestic, rural and commercial consumers but there would be "equitable adjustment for industry." The cost would be met over a period of twenty years partly from reserves and partly by stabilizing wholesale rates to the municipal distribution systems.

TRANSPORT

Darlington. — CHANGE-OVER. — The Town Council has approved a recommendation for the gradual change-over of the trolley-bus system to motor buses. Councillor J. Blumer appealed for a retention of part of the undertaking and pointed out that oil had to be imported and paid for in hard cash, which was the last thing the Government wanted at present.

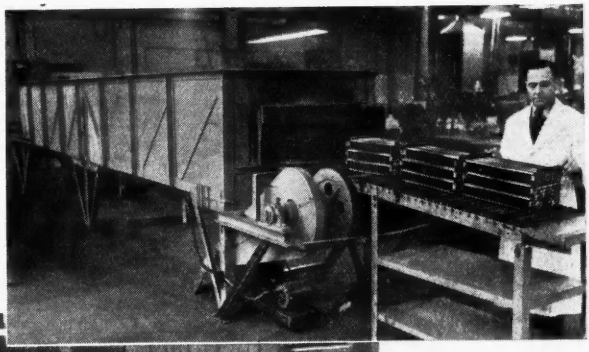
Glasgow.—PINKSTON POWER STATION DEVELOPMENTS.—The Corporation Transport Department proposes to carry out developments at Pinkston power station which will cost £1,800,000. Work will take from five to seven years and when completed the plant will be able, it is expected, to produce rather more power than is required for the operation of the transport services. Any surplus will be made available to the grid. In a report on negotiations with the Electricity Commissioners submitted to the Transport Committee, Mr. E. R. L. Fitzpayne, the transport manager, stated that more modest development would have sufficed for local needs, but it would have meant high fuel consumption and continuance at non-standard frequency. The Electricity Commissioners made it clear to a deputation that the installation of additional plant at non-standard frequency could not be authorized. They suggested that instead the Pinkston station should be converted from the present 25-cycle frequency to 50 cycles, and that it should be linked to the grid system. This change involved the installation of a new main 30,000-kW turbo-alternator, two 650 lb per sq in. boilers and a 260-ft cooling tower of 3,500,000 gal. per hr capacity and the adaptation of the substations. The Transport Committee last week approved the scheme, which will increase the capacity of the station from 45,000 to 55,000 kW.

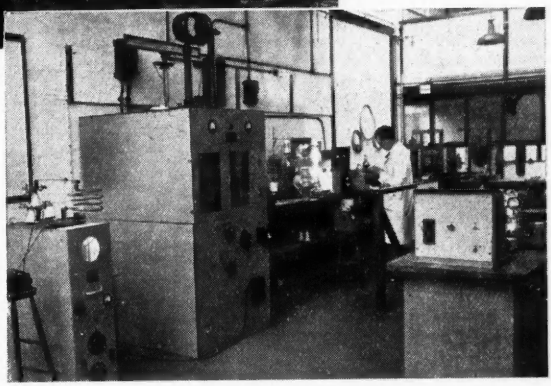
Rotherham.—PURCHASE OF TROLLEY-BUSES.—The Corporation has placed provisional orders with the Bristol Tramways & Carriage Co., Ltd., for the supply of 36 single-deck trolley vehicles for delivery at the rate of twelve a year.

Capacitor Manufacture

Use of Pilot Plant at New Factory to Improve Quality

THE provision of a separate pilot plant for small-scale manufacture of new types of mica and ceramic capacitors, metallized bushes, hermetic seals, etc., before putting them into full production is one of the methods adopted by the United Insulator Co., Ltd., at its new factory at Oakcroft Road, Surbiton, to ensure the highest possible quality products. Several hundreds or even thousands of a particular article are produced in this plant before the company is sufficiently satisfied with the design to pass it for full-scale production in the main factory.





Above : View of the pilot plant

Left : Part of the assembly department

Below : Load testing in the electrical laboratory

This plant is additional to an extensive research and development department, comprising both a materials section for developing and testing new materials and a components development section in which the prototypes of new products are designed, constructed and tested. Much of the testing apparatus both here and in the production departments has been designed and constructed by the company and considerable numbers of bridges for l.f. and h.f. measurements (1,000 to 1,000,000 cycles) are in use throughout the factory. Particular attention is in fact paid to testing apparatus at all stages of manufacture, and for proving the tropical finishes tropical chambers are used giving 100 per cent relative humidity and temperatures up to 100 deg C.

Before the war the company made only silvered mica type capacitors, but when hostilities stopped supplies of the ceramic materials and components from Germany, production of the latter was started within a reasonably short period. Now ceramic capacitors, which are claimed to be superior to the German products, are available from 0·5 pF to 1,000 pF, the range of silvered mica units having at the same time been extended to cover every capacitance from 5 pF to 200,000 pF. The main advantage of ceramics is, of course, the reduction possible in the size of the capacitors due to the high permittivity obtainable, which is stated to be from twelve to thirteen times that of mica.

Among several new products now being made is a high-load cylindrical type capacitor with a capacitance of 4,000 pF. It will take 150 kVA with a maximum of 55 A under normal conditions and will handle 300 kVA with a forced draught of 10 ft per sec. At the moment also a complete range of ceramic hermetic seals is being developed for use on capacitors, chokes, transformers, etc.

Apart from their application to the radio industry, the company's products are in ever-increasing demand for electronic devices, including high-frequency heaters. The General Post Office, too, besides using filter condensers for telephone work, is taking large numbers of ceramic trimming condensers for trimming radio-frequency circuits.

With about 120,000 sq ft of floor area available—three times that at its old factory at Clerkenwell—and a considerable amount of extra ground for expansion, the company should, when in full production, be able to meet all demands, while new production methods to be introduced shortly should further improve the quality and reliability of the products.

Radio Convention

Television, Automatic Telegraphy and Navigation Aids

LAST week's convention at Bournemouth of the British Institution of Radio Engineers included visits to technical establishments of the Admiralty (H.M.S. *Collingwood*), Ministry of Supply (S.R.D.E., Christchurch), British Overseas Airways, Ltd. (Hurn and Poole) and to the demonstration ship of the Decca Navigation Co., Ltd., as well as luncheons and a dinner-dance. Fourteen papers presented at daily morning and afternoon sessions (May 20th to 22nd), some accompanied by experimental demonstrations, commenced with an examination by Prof. H. M. Barlow of the possibilities of employing trunk wave guides for conveying micro-waves for multi-channel communication. Drs. H. Gutton and J. A. Ortusi dealt with ultra-high-frequency modulation by the insertion of variable impedance into a wave guide for the transmission of television signals with high definition.

Trenches Instead of Masts

Television receiving aerials was Mr. D. A. Bell's subject, while the development of medium-wave broadcasting antennæ was outlined by Mr. H. P. Williams, who referred to the future possibility of utilizing deep trenches instead of high masts, which should direct most of the radiation along the ground and would not obstruct low-flying aircraft.

International automatic telegraph networks as developed during the war in the U.K. and U.S.A. were described by Commander J. D. M. Robinson, R.N., with particular reference to message storage inter-circuit technique; and Dr. E. V. D. Glazier added a section on the integration of land-line and radio-link requirements, particularly in the case of mobile units like ships, vehicles and aircraft.

Radio navigation aids (including the Decca) were described by Mr. W. J. O'Brien; the functional requirements of radio aids to civil aviation were explained by Capt. V. A. M. Hunt; experimental radio communication with moving railway trains in this country and abroad was discussed by Mr. G. H. Leversedge; while the salient features of a 1-kW very-high-frequency modulated transmitter for broadcasting were summarized by Mr. J. B. Lovell Foot.

High-fidelity recording and reproduction were dealt with by Messrs. W. S. Barrell and G. F. Dutton; the "Redifon" automatic audio-frequency response curve tracer was described by Mr. G. L. Hamburger and a direct reading frequency measuring set by Mr. F. C. F. Phillips; the use of the klystron as a radio-frequency amplifier at centimetric wavelengths was explained by Dr. R. Kompfner, and transmitting valves for short wave communication were reviewed by Mr. A. H. Aldous.

Irish Short-Wave Service

Eire is to have a high-power short-wave broadcasting service by the end of the present year. The Minister for Posts and Telegraphs told the Dail last week that the erection of the station would cost £171,000 and maintenance £56,000 a year.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The London Electric Wire Co. & Smiths, Ltd. — In the course of his speech at the annual meeting held on May 21st Mr. W. J. Terry (chairman and managing director) said that the present difficulties in obtaining raw materials were much greater than at any time during the last war, mainly due to inadequate supplies of coal. There was a world shortage of most of the metals required by the electrical trade. Home sales were increased in value and volume during 1946 over the previous year, but the output was far below the demands and could have been greatly increased by the relaxation of controls and adequate supplies of material and labour. The order book was the largest on record and although there might be a certain amount of over-ordering there was still a firm undertone. There was an increase in export sales during 1946.

Referring to the nationalization of the coal, electricity supply and transport industries, Mr. Terry said that he was of opinion that private enterprise was still the best policy of this country. Any departure therefrom should be preceded by exhaustive examination and each new proposition should be proved to be successful in supplying better service to the community before further commitments were hurriedly entered into. Whilst stressing the difficulties confronting manufacturers to-day it was not in any defeatist attitude that the company faced the future.

Johnson & Phillips, Ltd.—Mr. G. Leslie Wates (chairman and joint managing director) stated at the annual meeting that their order book was the largest in the company's history, but shortages of labour and materials had made it impossible for them to accelerate output to keep pace with the increasing business. The demand for electrical products seemed almost limitless at the moment, but they must envisage the time when Central Europe would again be producing and when the great industries of the United States would have overtaken their home demand.

Laurence, Scott & Electromotors, Ltd., held their annual meeting at Norwich recently, when Mr. G. H. Wilson (chairman), who presided, said that their orders in hand were at the highest level ever known in the history of the company and covered a wide range of industries and applications, notably electrical equipment for many new power stations, for mines, steel works, machine tools and rubber machinery, and motors, generators, switchgear and winches for the merchant navy. They had suffered considerably during 1946 from shortage of supplies, and this position was not improving. They had completed their reorganization from war to peace, and through the creation of the new preference share capital in November last they had adequate available resources. What was lacking was any real confidence in stable trading conditions to enable them to get on with the job without interference or interruption. The complete cut in power supply early this year was a major disaster of which they were still feeling the effects.

The sum of £28,400 E.P.T. recoverable is included in the trading profit of £120,551 for the year and is not additional to that figure as stated in our last issue.

Tube Investments, Ltd.—An agreement has been reached with Hawker Siddeley Aircraft, Ltd., to merge the two companies' aluminium interests. For this purpose a holding company, in which each group will have an equal share, will be formed to take over the share capital of the subsidiary companies concerned, namely, High Duty Alloys, Ltd., the Reynolds Tube Co., Ltd., and Reynolds Rolling Mills, Ltd. Development plans include the establishment of a modern rolling mill to produce aluminium sheet and strip competitively for the world market.

The Para Electric Railways & Lighting Co., Ltd.—At a further meeting of the 6 per cent debenture stockholders which was held on May 21st, resolutions prolonging the moratorium were approved by the stockholders. The board have received news that with the object of ensuring an adequate supply of power to local factories the tramway service was suspended as from April 27th by order of the authorities. They are unable as yet to judge exactly what effect this suspension would have upon the position of the company, which remains precarious.

London Associated Electricity Undertakings, Ltd., reports a profit for 1946 of £401,898, as compared with £401,121 for the preceding year. Tax requires £20,789 and the ordinary dividend for the year is maintained at 6 per cent. The balance carried forward is £26,135 (against £232 brought in).

Lightfoot Refrigeration, Ltd., is paying a final dividend of 5 per cent, making 8 per cent for the year. Only one payment of 7½ per cent was made in the previous year and this included 2½ per cent, tax free, from capital reserve.

Vactric, Ltd.—Speaking at the annual general meeting, Sir Frederick Whyte, chairman, said that, despite all drawbacks, production at Chapelhall had achieved considerable success. An agreement had been made with the Apex Electrical Manufacturing Co., Cleveland, Ohio, for the manufacture of a washing machine.

The Newhorse factory was still not completed and the date on which it may be ready for occupation is now given as next September.

The British Thermostat Co., Ltd., reports net profits, before taxation, for the year ended January 31st, amounting to £130,031, as compared with £107,782 in the previous year. In addition there is available a sum of £4,704 reserve for losses of subsidiary companies no longer required. Taxes again account for £88,000, but no contribution is made to the general reserve. In addition to the dividend of 18½ per cent (same) on the ordinary and founders' shares there is a bonus of 5 per cent (nil). A refund of about £25,000 for E.P.T. is expected. The carry-forward is increased from £21,651 to £47,219.

The Merthyr Electric Traction & Lighting Co., Ltd., reports a net revenue for 1946 of £49,020 (£45,305). The dividend is maintained at 8 per cent and £14,840 (£5,286) is carried forward.

The Weston-super-Mare & District Electric Supply Co., Ltd., records a net revenue for 1946 amounting to £77,847 (£69,364). The dividend is again 8 per cent and £18,672 (£4,686) is carried forward.

New Companies

M.C.L. Electrical, Ltd.—Registered May 17th. Capital, £50,000. Electrical engineers and contractors, manufacturers of, and dealers in, dynamos, lighting equipment, accumulators, etc. Directors: C. G. Peel (director of Ranalah, Ltd.) and W. J. Merrifield and J. E. Naismith (directors of M.C.L. & Repetition, Ltd.) Regd. office: Pool Lane, Langley, Birmingham.

White Hart Electrix, Ltd.—Registered April 2nd. Capital, £2,000. Manufacturers of, and dealers in, electrical and mechanical apparatus and accessories, wireless sets, etc. Directors: R. C. J. Gilbert, Elsie M. Gilbert, and N. W. Johns and Alice M. Johns.

Sanderson & Shayler, Ltd.—Registered May 7th. Capital, £10,000. Manufacturers of, and dealers in, electro-medical apparatus, medical, electrical, and electronic apparatus, radio equipment, etc. Subscribers: G. Campling and H. J. E. Shayler. Regd. office: 21, Devonshire Street, W.1.

W. J. Fletcher (Batteries), Ltd.—Registered May 7th. Capital, £1,000. W. J. Fletcher is the first director. Regd. office: 2, Whittaker Street, Doncaster.

Cosmo Electrical Trading Co., Ltd.—Registered May 6th. Capital, £3,000. L. Price is the first director. Regd. office: Standbrook House, 2-5, Old Bond Street, W.

Tower Electrics (Leatherhead), Ltd.—Registered April 22nd. Capital, £1,000. To acquire the business of electrical contractors and radio and electrical engineers carried on by J. E. Loosley, S. Crossweller and E. G. Race at The Tower, Radio House, 6a, North Street, Leatherhead. Directors: The above-named and H. R. Swetman. Regd. office: 6a, North Street, Leatherhead, Surrey.

Bankruptcies

F. A. Tarbox, company director, trading as "Tudor Electrical Services," Station Yard, Mill Hill, Middlesex, electrical engineer.—The first meeting of creditors was held recently at Bankruptcy Buildings, Carey Street, London, W.C., when it was reported that the debtor estimated his liabilities at £1,044 and valued his assets at £383. A resolution was passed for the appointment of Mr. N. G. Randall, 19-20, Grosvenor Place, London, S.W.1, as trustee of the estate.

J. Eisner, J. Sunshine, B. Rome and T. Otaki, trading together in co-partnership as the Lloyd Electric Lamp Co., 8, Rangoon Street, London, E.C.3, wholesale electrical accessories dealers, and lately of 4, Lloyd's Avenue, London. (Separate estate of J. Eisner).—First and final dividend of 20s. in the £, payable June 3rd at Bankruptcy Buildings, Carey Street, London, W.C.2.

E. Ramsey, lately residing and carrying on business at 1, Springfield Place, Hunslett Carr, Leeds, but now residing and carrying on business at 8, Springfield Place, Hunslett Carr, Leeds, electrical engineer.—First and final dividend of 20s. in the £, payable June 6th at the Official Receiver's Office, 29, East Parade, Leeds.

D. W. J. Prentice, 59, Brecon Road, Fulham, London, S.W., electrical engineer.—Last day for receiving proofs for dividend June 4th. Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver.

J. Reynolds, 4, Alexandra Crescent, Derker, Oldham, formerly carrying on business as "Rayham Neon Signs."—First meeting, June 3rd, at the Official Receiver's office, 20, Byrom Street, Manchester. Public examination, June 16th, at the Court House, Church Lane, Oldham.

Rayham Neon Signs (a firm), 4, Alexandra Crescent, Derker, Oldham, Lancs, electrical dealers.—Receiving order made May 12th on a creditor's petition.

C. Rodgers, 16, Howard Road, Pomphlett, Devon, electrical engineer.—Receiving order made May 8th on a creditor's petition.

Winding-up Petition

Frank Murphy of London, Ltd.—A petition for the winding-up of this company, presented by Multicore Solders, Ltd., is to be heard in the High Court on June 9th.

Liquidations

Electric Driers, Ltd.—Winding-up voluntarily. Liquidator: Mr. R. H. Stevens, 38, King William Street, London, E.C.4.